MARCH 1961 / 50¢

# AIR FORCE

## and SPACE DIGEST

The Magazine of Aerospace Power / Published by the Air Force Association

USAF'S NEW SUPERSONIC TRAINER

. . . SEE PAGE 99

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**WHO** tapped the sun for electric power by inventing the Solar Battery?

**WHO** used the moon for two-way conversations across the country?

# who?

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**WHO** made your pocket radio possible by inventing the Transistor?

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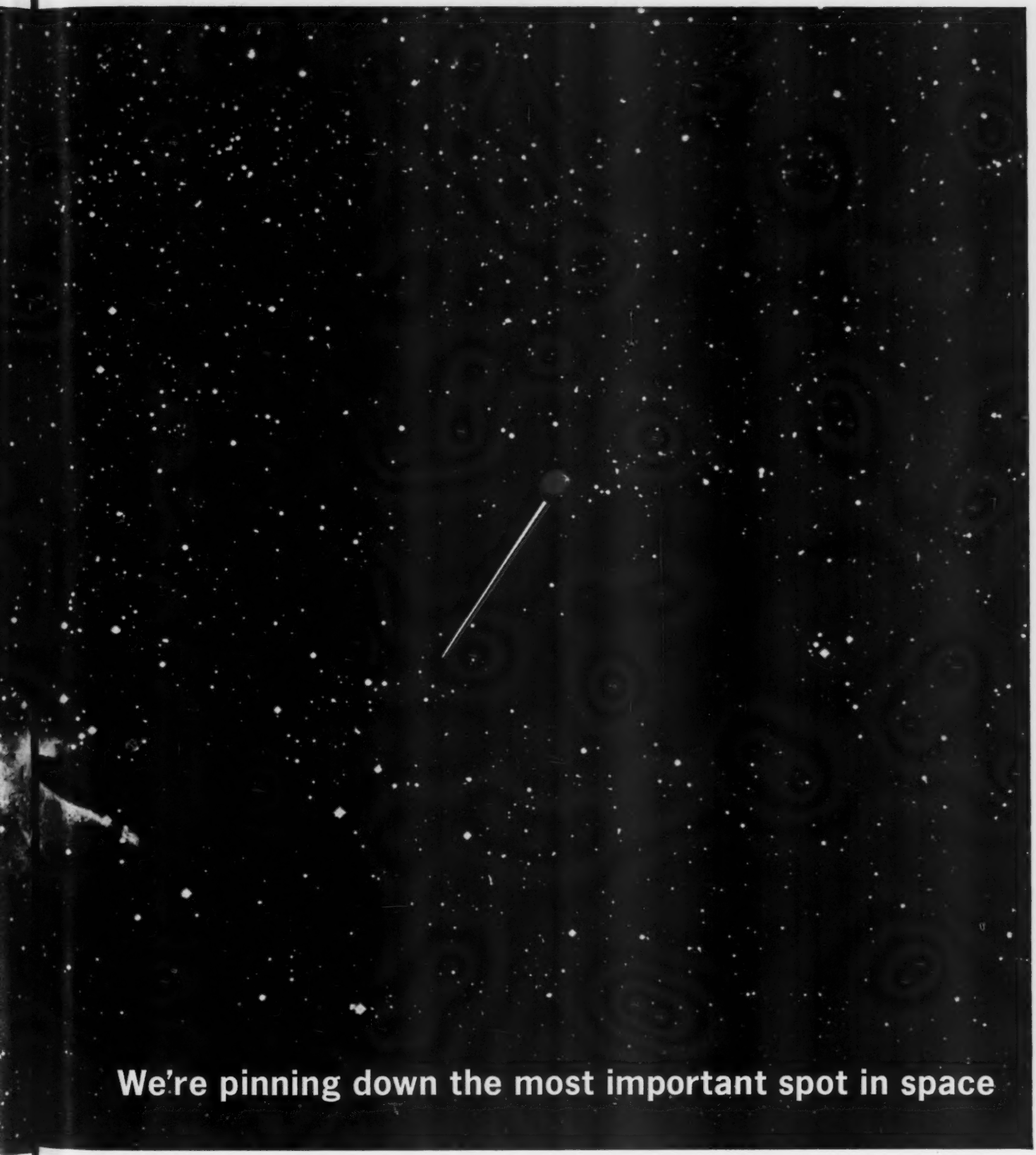

## We're pinning down the most important spot in space

tion and propulsion; in-space rescue, repair and refueling; space medicine and human engineering for crew survival; and re-entry and recovery systems to bring astronauts safely back to earth.

When men finally move out into space, Northrop equipment and techniques will make the task simpler and safer.

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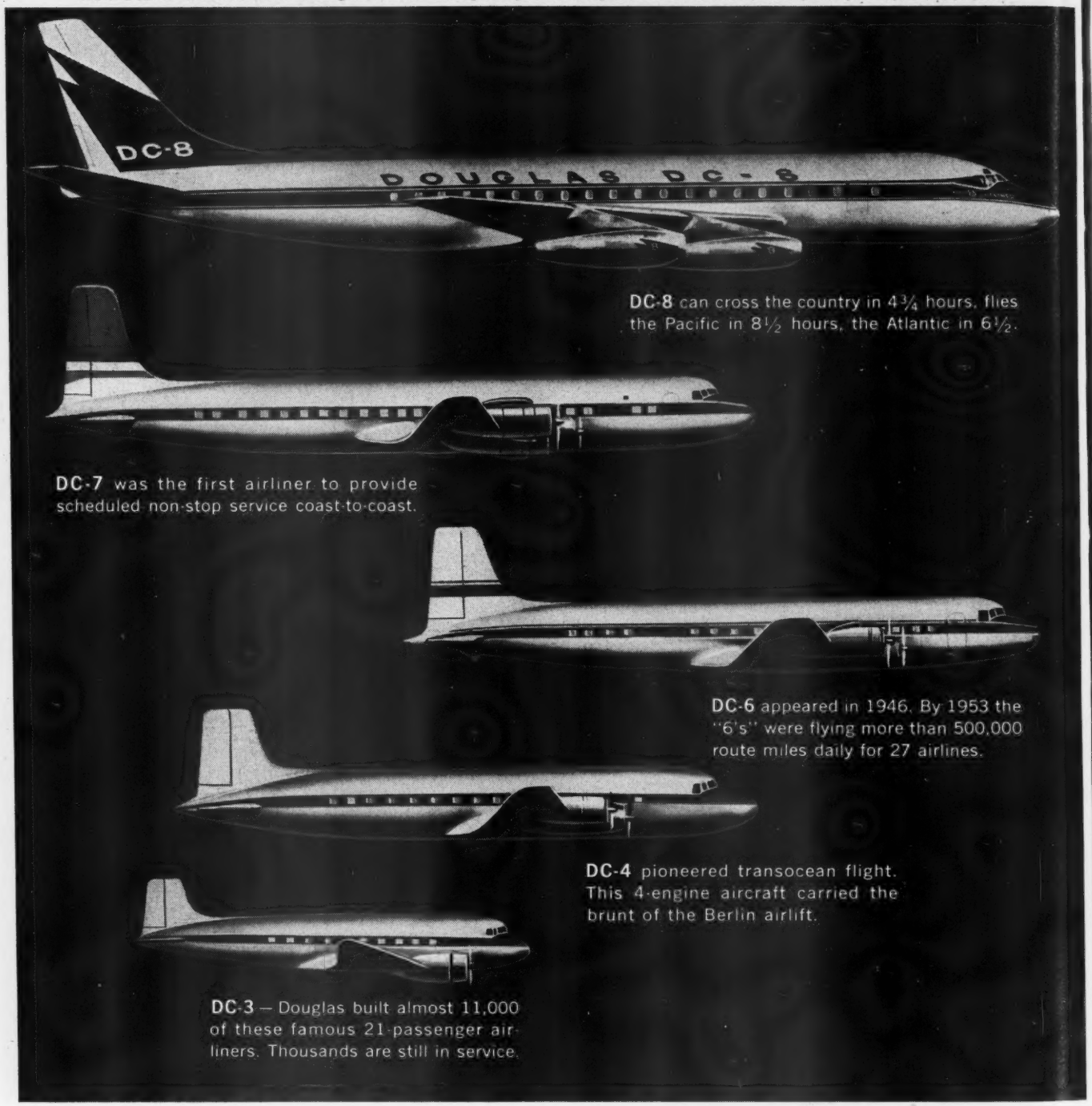
**NORTHROP**

One of a series of advertisements showing the breadth of Douglas experience being devoted to commercial, military and space-exploration projects.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# AIR FORCE

and SPACE DIGEST

*The Magazine of Aerospace Power* / *Published by the Air Force Association*



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## FEATURES


*The Gap-Fillers*
JOHN F. LOOSBROCK ..... 6

*That Deceptive Sino-Soviet "Split"*
A SPECIAL REPORT ..... 43

*Propulsion: Many Roads Go Up (Part II—Space Engines)*
J. S. BUTZ, JR. ..... 48

*"Defective at the Top"*
HARRY HOWE RANSOM ..... 58

*Safety in Numbers*
A SPECIAL CONTRIBUTION ..... 66

*T-38—This Trainer Can GO, GO, GO ...*
ED MACK MILLER ..... 99

*Getting the Message Through*
LT. COL. CARROLL V. GLINES, USAF ..... 126


## SPACE DIGEST


*Long Ride for a Game Chimp*
CLAUDE WITZE ..... 73

*Three Theories on the Craters of the Moon*
JOHN W. MACVEY ..... 74

*James E. Webb—New Boss at NASA* ..... 80

*Teaching Machines—Bane or Blessing?*
CHARLES M. WEISENBERG ..... 84

*Speaking of Space*
WILLIAM LEAVITT ..... 91


## DEPARTMENTS


*Airmail* ..... 11

*What's New With Red Airpower* ..... 15

*Aerospace World* ..... 20

*Airpower in the News* ..... 33

*The Ready Room* ..... 103

*Tech Talk* ..... 109

*AFA News* ..... 115

*Airman's Bookshelf* ..... 121

*Index to Advertisers* ..... 124

*This Is AFA* ..... 130



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*An Editorial*

# THE GAP-FILLERS

**John F. Loosbrock**

EDITOR, AIR FORCE/SPACE DIGEST MAGAZINE

BY THE time this is read, the furore over the missile gap, so-called, may be off the front pages and back with the goiter ads. That is probably where it belongs. Nevertheless, we have to go with what we have at deadline, a hard fact of the publishing business, whether one works for a daily, a weekly, a monthly, or even an annual. And at this writing the "missile gap" is hard news. Or, more correctly, it is being used as a device to generate hard news. In any case, there is a gap—or there isn't one—or there may be one—and if there is, it is important—or it isn't important even if there is one because there isn't a "destruction gap." And so it goes.

What bothers us is that Mr. American Taxpayer, who pays his share of more than $40 billion a year to get some assurance of security and ten cents a day to read about whether he's getting his money's worth, must be a little confused. We don't blame him, because assessing our national defense program by counting missile noses makes about as much sense as writing a review of "Ben Hur" after seeing only one scene. Or, to be more accurate, to write a review on the basis of what someone told you he thought he saw when he watched the scene being shot.

We're not going to try to make sense out of the specific issues of the controversy at this juncture. Too much time will elapse between our writing and your reading. But we do want to drop a few caveats which may help to put the day-by-day news in some sort of perspective. We won't be so presumptuous as to supply all the answers, but we do think we can furnish some pertinent questions with some pertinent considerations which bear on the answers:

**Question 1. How do we know how many missiles the Soviets have?** We know how many we have. The Russians won't tell us how many they have. In fact, they don't like it when we try to find out. We know from their space achievements that Soviet rockets can throw big loads long distances at great speeds. We no longer have a U-2 program to tell us much more. So the fact that we have "no evidence" of a Soviet crash program in missiles is not exactly surprising. But it isn't a very solid peg to hang your strategic hat on.

**Question 2. What are the national intelligence estimates on which the current assessment of Soviet missile strength is presumably based?** These come from no single source. They represent inputs from the Central Intelligence Agency, from the not-always-objective intelligence organizations of the military services, from counterintelligence agencies, spies, informers, defectors, and other sources. It is reasonable to assume that they represent a good deal of compromise, like a decision of the Joint Chiefs—somewhere in the middle of a spectrum ranging from lugubriously pessimistic to idiotically optimistic. They can be interpreted in the light of what one thinks the Soviets might do or in terms of what they can do, should they so decide. They are guides for decision, not the Ten Commandments.

**Question 3. Do we need to match the Soviets missile for missile?** The factors which bear on this question must be as carefully qualified as were Mr. McNamara's unquoted comments to the Pentagon reporters in that now famous "background briefing" on the "gap." What counts is your ability to deliver damage or the enemy's ability to hurt you, not whether the damage is inflicted by Air Force Atlases, Navy Polarises, bombs from manned aircraft, or suitcase explosives planted by saboteurs. How much it takes to do this is governed by such factors as warning time, hardening, the force mix as between manned bombers and missiles, dispersal, mobility, command and control, on whether we really want to be able to hit the enemy's forces or whether we just want to scare him off by threatening to kill his people. This sample of a few of the things one must think about in building a force and designing a strategy serves primarily to illustrate the complexity of a problem for which easy answers are too often given.

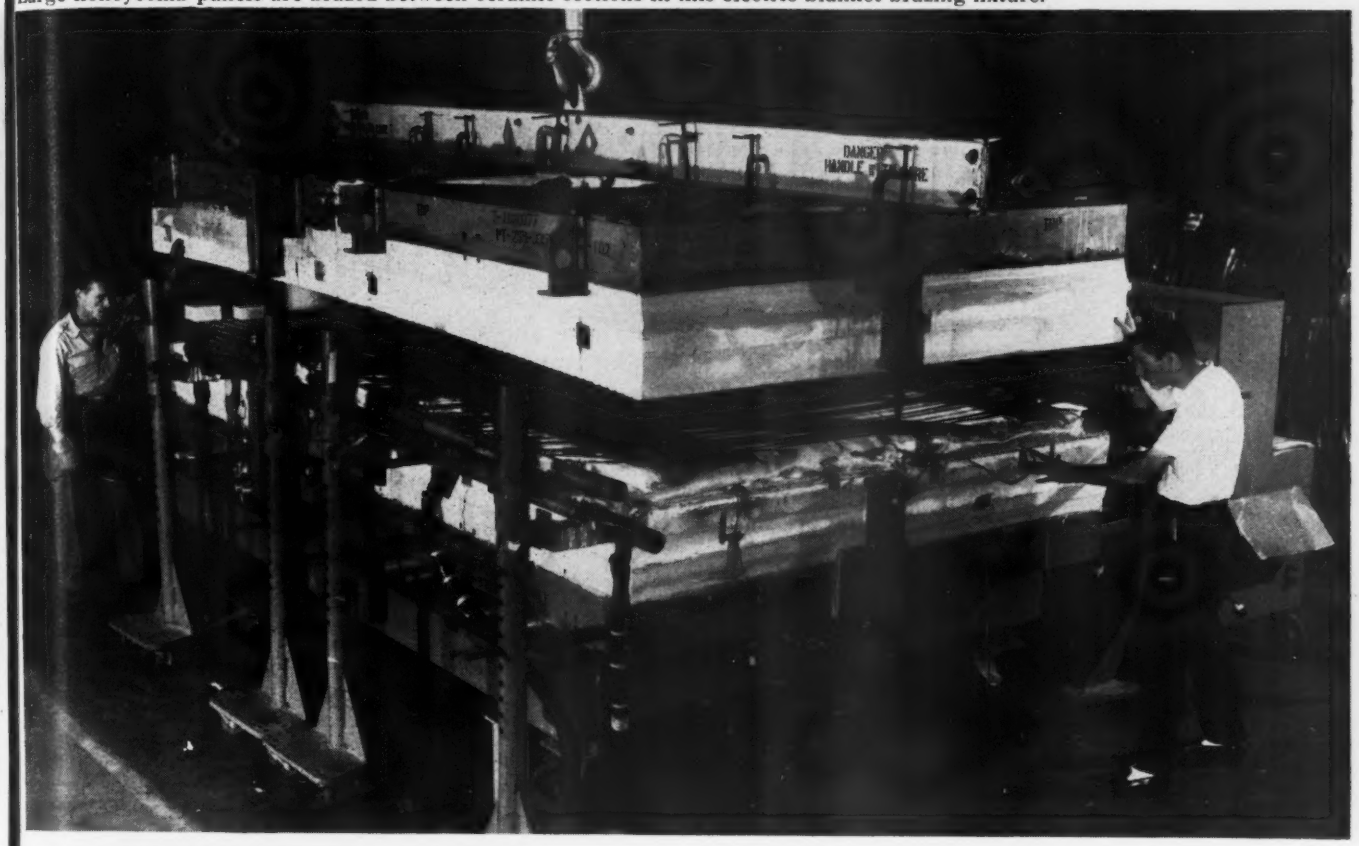
**Question 4. Are the big missiles, or, indeed, the whole strategic delivery complex, any good against limited aggression?** Apart from any other considerations, it would appear that one useful purpose they might serve would be to ensure that limited aggression remained limited. The reverse is not necessarily true. In fact, our building a capacity to win limited wars at the expense of our ability to wage—and win—general war could be the best way to ensure that a general war would occur—and that we would lose it. From the standpoint of the security of the United States, limited wars are not fatal. A general war could be, especially if we planned it that way. In most discussions of this topic one notices an interesting paradox. In discussing the amount of general-war capability that we need, the limited-war proponents always add up numbers of big bombers, big missiles, little bombers, little missiles, submarines, carriers, and the capability of our allies, and often arrive at a condition they describe as "overkill." But in pointing out our deficiencies in the limited-war area, these same capabilities, a high proportion of which are dual purpose, are not factored into the equation. If they were, the limited-war deficiencies would not be nearly so dramatic.

**Question 5. But what would happen should there be another Korea?** This is an interesting question and even more interesting if you make it six or seven Koreas—simultaneously. If we shave our general-war deterrent to a "minimum" level, so that we can divert substantial resources to limited wars, the Soviets can do the same and run us ragged all around the world. If part of Soviet strategy is to bleed our economy, it is difficult to think of a better way to help them do it.

**Question 6. After all, isn't thermonuclear war so horrible that no one will allow it to happen because no one would win?** This thought comes uncomfortably close to appeasement. It suggests that no fate could be worse than participating in, regardless of "winning" or "losing," a thermonuclear war. If we buy it, then—so the story goes—the optimists among us will teach their children Russian, the pessimists will teach them Chinese.

There are a lot more questions that could be asked, just as there are a lot of gaps that must be filled—like those between the ears of some of the people who carry on public discussions on these matters.—END

Large honeycomb panels are brazed between ceramic sections in this electric blanket brazing fixture.



# Mach 3 Manufacturing

## Making an aircraft skin tough enough to withstand the heat barrier

To cope with the heat barrier and cruise at speeds in excess of 2000 miles an hour, an aircraft needs a skin unlike that of any plane in existence. Traditional covering methods were out of the question.

To solve this problem, the engineers and scientists at the Los Angeles Division of North American Aviation carried on further experiments with the techniques of manufacturing stainless steel honeycomb. They found that by sandwiching this honeycomb between two sheets of steel, sometimes only six thousandths of an inch thick, structural sections could be obtained with excellent insulating characteristics and stiffness approaching a solid slab of steel, yet would be far lighter.

The problem of brazing these honeycomb panels to meet the oven-hot temperatures of Mach 3 speed required an intensive development program. In conjunction with NAA's team of subcontractors, experiments were made with many kinds of brazing methods. One in particular would give high-quality results, with economy. This method utilizes a ceramic form to hold a honeycomb panel at controlled heats of over 1625 degrees.

As a result of this advanced development in the art of making aircraft coverings, a plane can now have a skin so tough it is well able to withstand thermantic speeds.

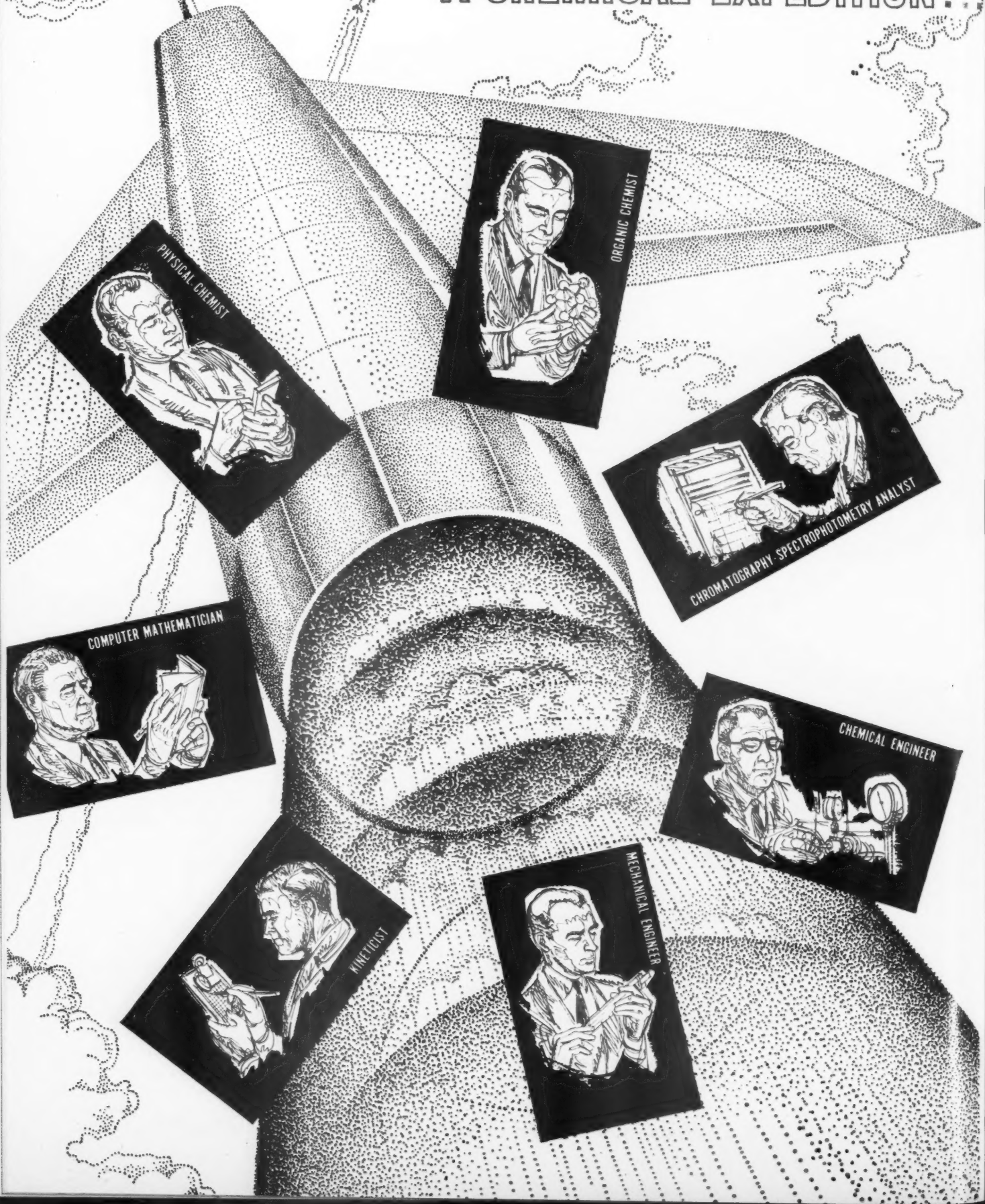
This technological breakthrough will help sustain America's leadership in aircraft and make possible the supersonic manned weapon systems and commercial aircraft of the future. Because of metallurgical achievements in supersonic fabrication, the American Society of Metals gave North American its 1959 Advancement of Research Award.

THE LOS ANGELES DIVISION OF **NORTH AMERICAN AVIATION, INC.**

Monsanto

Space-Age Project "SUPER THRUST"

# A CHEMICAL EXPEDITION...



# ...exploring hydrocarbons for High-Mach fuels... seeking new paths to heat stability

*Monsanto research is making significant strides forward in the search for heat-stable hydrocarbon fuels for the next generation of jet engines. Working under contract with the propulsion laboratory, Wright Air Development Division, Monsanto chemists are blocking out a variety of hydrocarbon compounds for fuels "task-tailored" to engine design requirements. These fuels promise to meet the three most pressing fuel requirements:*

*High thermal stability*
*High energy per unit of weight and volume*
*Optimum heat-transfer capability*

To meet stringent fuel requirements as they become more closely defined for advanced jet engines, Monsanto has screened some 6,000 chemical compounds. More than fifty hydrocarbons have been selected for intensive evaluation based on their promising physical properties.

From the exhaustive search and confirming experimentation, Monsanto research has determined that a hydrocarbon fuel is within reasonable reach that will not decompose or "gum" in the 600°-800° F. range. Its high heat stability will enable it to serve as the heat sink . . . essential in advanced-design jets to relieve the lubricant, engine components, thrust chamber and "skin" from heat stresses.

## IMPROVED DUAL-PURPOSE FUEL: ENERGY AND HEAT SINK, HEAT STABLE, SUPER THRUST

From current study, it appears that the compound with optimum jet fuel properties may turn out to be either a relatively simple mixture of highly "pure" cyclic, saturated chemicals or narrowly selected fractions of refinery streams, hydrogenated to saturation and carefully separated. This necessarily would be a chemically made fuel, not a run-of-refinery mixture. As such, it would provide more closely defined physical and chemical properties for predictably uniform performance.

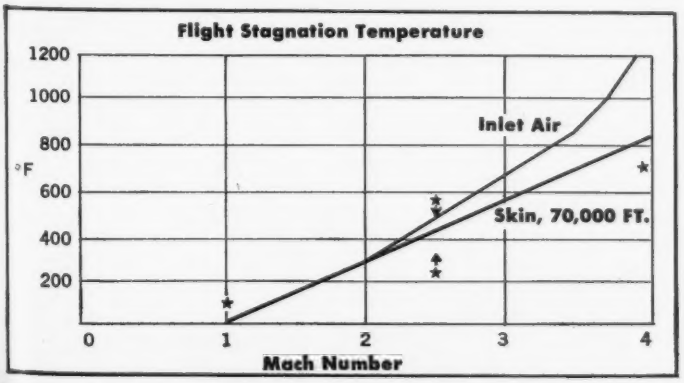
Its requirement parameters are becoming fairly clear: BTU's per pound—18,500 to 19,000 minimum; specific gravity—0.85 to 0.95 (or heavier); no coking or "gumming" to 800° F. In addition to heat stability, next-generation jet fuels must have maximum heat of combustion (on a weight-and-volume basis) to increase the jet craft range.

Monsanto is in an unusually sound position to help engine makers and the military in solving the fuel problem. Its Special Projects Laboratories are staffed and oriented for precisely this type of research. In addition, Monsanto's Organic Chemicals Division has a basic position in aromatic compounds. Through its Lion Oil Division, Monsanto has a basic supplier position in refinery products (and the research facilities) to study the possibilities in paraffins, naphthenes and close cuts of refinery streams.

Several candidate fuels have already been prepared and manufactured in evaluation quantities; for example, isopropylbicyclohexyl. Study is continuing in many other areas, including both naphthenes and paraffins. Most important, with a variety of "candidates" Monsanto next needs to know specifications based on design: the density limits, exact heat stresses, minimum thrust limit. With these parameters "jelled," Monsanto can guide the engine maker to a variety of candidate cyclic or paraffinic hydrocarbons for evaluation.

## ENDOTHERMIC-REACTION FUELS— ANOTHER AVENUE TO "SUPER THRUST"

Chemically, there is little chance that a saturated hydrocarbon fuel stable above 900° F. will be found.




At subsonic speeds, engine heat can be dissipated by convection to the air. At speeds higher than Mach 1.4, the rate of air cooling reaches borderline; at High-Mach speeds, air cooling is inadequate. The frictional heat of aerodynamic drag and the reject heat of engine combustion must be dissipated to some part of the vehicle or its load. Conventional liquid JP-4 fuel, a refinery stream hydrocarbon cut, reaches its borderline limits of heat stability near speeds of Mach 2.5. Fuels having higher limits of heat stability are required.

**Approximate cooling requirements:**

| Mach Number | HEAT SINK, BTU/lb. of Fuel Required | Available JP-4 † |
|---|---|---|
| 1.0 | ★ 130 | 170 |
| 2.5 | ★ 220-550 | 170 |
| 4.0 | ★ 725 | 170 |

† Conventional liquid jet fuel heated from 100-400° F

(*Please turn page*)

However, a fuel system may be developed—with compounds capable of undergoing endothermic reactions—that will operate in environments in the 1200-1900° F. temperature range. Basically, this requires the development of a compound to be converted *in flight* to the actual fuel, in a "package" chemical converter that would utilize part of both the reject heat of fuel burning and the friction heat of aerodynamic drag. Endothermic fuels show promise of increasing vehicle range through greater fuel efficiency, since heat energy normally lost is absorbed during the endothermic conversion and released during combustion. A few of the promising possibilities programmed for experimentation:

**THERMAL CRACKING OF HYDROCARBONS:**

Cracking:

$$C_8H_{18} \longrightarrow C_4H_8 + C_4H_{10}$$

Heat Absorbed: 370 BTU/lb.

**DEPOLYMERIZATION TO OLEFINS:**

Diisobutylene

$$CH_2{=}C(CH_3)CH_2C(CH_3)_3 \longrightarrow 2(CH_3)_2C{=}CH_2$$

Heat Absorbed: 390 BTU/lb.

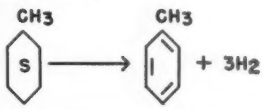
**RETRODIENE SCISSION:**

Monomerization of dicyclopentadiene

Heat Absorbed: 310 BTU/lb.

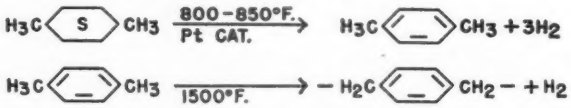
**DEHYDROGENATION AND AROMATIZATION:**

Dehydrogenation of 6-membered naphthene to an aromatic



Heat Absorbed: 900 BTU/lb.

**STABILIZED HIGH-TEMPERATURE FREE RADICALS (Series Reaction):**



Total Heat Absorption (sensible heat plus heat of reaction): 3980 BTU/lb.

Monsanto research has blocked out several more "types" of endothermic reaction, each with dozens of specific compositions, as promising starting points for heat-sink fuels to power supersonic craft.

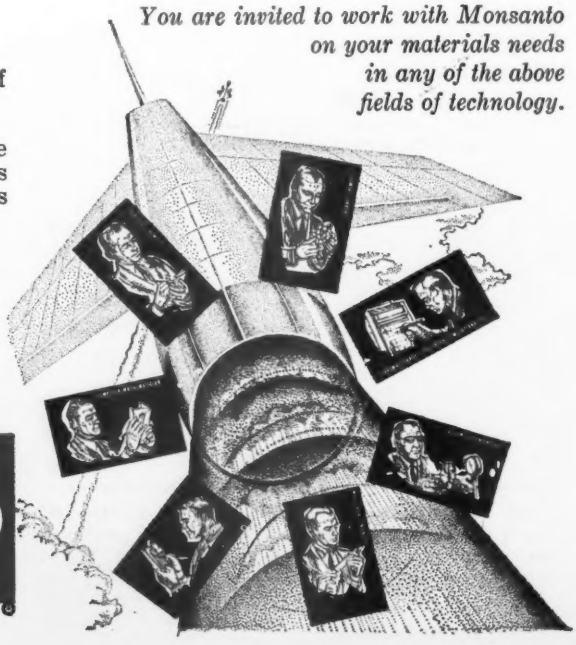
**CHEMICAL FUELS—ANOTHER CHEMICAL CAPABILITY OF MONSANTO**

Where design and fuel performance are interdependent, you are invited to enlist Monsanto's capability on the chemistry of the fuel. Write or call: MONSANTO CHEMICAL COMPANY, Department AF-1, C Building, St. Louis 66, Missouri.

**Monsanto Space-Age Projects for Government and Industry**

* High-Temperature Hydraulic Fluids
* Coolant-Dielectrics for Electronic Equipment
* High-Temperature Plastics
* Improved Nitrogen Oxidizers for Solid Propellants
* Fire-Resistant Structural Plastics
* Hydrocarbon Fuels for Jets and Missiles
* Fire-Resistant Hydraulic Fluids for Ground-Support and Missile-Launching Equipment
* Radiation-Resistant Heat-Transfer Fluids
* High-Temperature Lubricants and Additives
* Radiation-Resistant Reactor Coolant-Moderators
* Intermetallic Semiconductor Materials
* Pure Silicon for Transistors, Rectifiers, Diodes
* Ultra-Fine Metal Oxides
* Materials for Vibration Damping
* Heat-Resistant Resins for Laminating and Bonding
* Inorganic Polymers
* High-Energy Solid Propellants

*You are invited to work with Monsanto on your materials needs in any of the above fields of technology.*



Monsanto

### A Matter of Grave Concern

*Gentlemen:* I have read your article, "The Challenge to Aviation in the Cold War," by Claude Witze, in your January issue. May I compliment you on having done an excellent job of highlighting what we and our country face in the cold-war aviation "attack" which the Russians have launched.

We need to know much more about this threatening situation. More important, the message of what is happening in this area must be continually and forcefully brought to the attention of the public by farsighted editors like yourself. Please keep up the good work and you can count on our cooperation.

Orval R. Cook, Pres.
Aerospace Industries Association of America, Inc.
Washington, D. C.

*Gentlemen:* That was an excellent article on the Russian competitive situation in the January issue of AIR FORCE/SPACE DIGEST entitled "The Challenge to Aviation in the Cold War," by Claude Witze.

You who appreciate how far and how fast this aspect of the cold war "ground fire" has spread can and are trying to do something about it. We are greatly handicapped by lack of sufficient, authentic information on the subject. It is not enough to sound the alarm when, as in India, Ghana, and other countries, small "fires" break out in the open—then the damage is done. First, we need to impress on our government the necessity of drawing on all of its commercial intelligence sources to clarify the picture in the hope that with such knowledge government and industry may join forces while it is not too late to do something about it. Too often "brush fires" instigated in Moscow are not a matter of concern until they break out, beyond control, in other isolated and politically more sensitive areas.

You have come out frankly in your article and I hope there will be much more of the same. . . .

L. H. Taylor
Washington, D. C.

*Gentlemen:* Your article . . . was very timely. The aircraft industry should hear more about the Russian aviation activities and what they are doing to sell their products in the free world.

I hope that many people in the aircraft industry will read this article because I am sure that they will benefit by it. . . .

John M. Weikert
United Aircraft Export Corporation
Washington, D. C.

*Gentlemen:* Claude Witze and AIR FORCE/SPACE DIGEST are to be commended for the perception and concise presentation of problems of vital importance to the free world. . . .

The inclusion of Mr. Witze's article in the *Congressional Record* of January 26, 1961, is indicative of the concern felt by members of Congress over a situation which must somehow be remedied—and soon. This is one of the many challenges facing the Administration of the "New Frontier."

Harlan S. Hosler
The Kaman Aircraft Corporation
Washington, D. C.

● *Congressman Emilio Q. Daddario (D-Conn.), in placing the article in the* Congressional Record, *commented:*

*"Many of our products are the finest in the world. Yet today we are facing increasing difficulties in making sales abroad, and the results are reflected in our balance of payments and in employment worries throughout the nation.*

*"The troubles fall in several categories. Most important probably is an exaggerated government sense of red tape which prevents American manufacturers from releasing specifications or making schedules until it is too late to make the sale. Another is an indifference in recent years to international record competitions which would clearly demonstrate the superiority of American products and assist our workmen in selling their products.*

*"It should be the determination of all our people to widen and maintain our lead in the world in industrial excellence. I hope the new Administration will unleash and aid the talents of our people in this regard."*

—THE EDITORS

### Space Professor

*Gentlemen:* I believe you are aware, from comments I have made before, of the very high opinion I hold for your magazine. Your coverage and treatment of Air Force subjects are exceptional, and I am particularly impressed with the comprehensive job you are doing in the SPACE DIGEST portion of each issue.

The article you have printed on Lieutenant Baker of this Headquarters ["Professor in a Blue Suit," by Lois Philmus, January '61] represents precisely the kind of public recognition that is fruitful in the Air Force's continuing effort to obtain personal identification for the many fine officers diligently working in this somewhat abstract business of space. I feel sure that more articles of this nature would serve to encourage our research and development officers, and also to enforce in the public image the tremendous native ability which the Air Force possesses with respect to progress in aerospace. . . .

Maj. Gen. O. J. Ritland, Commander
AF Ballistic Missile Division (ARDC)
Los Angeles, Calif.

### Answer to the Problem?

*Gentlemen:* As an advanced AFROTC student, I read your January article, "'New Look' in the Quadrangle," by Frederic M. Philips, with much interest.

It is true that there is a pressing need for the revamping of the Air Force's officer procurement system on the college campus. The AFROTC does not usually get the best students, scholastically, because its time-consuming nature deters the real scholar, or at least it distracts the one who does persevere in the program.

However, I do not think that a three-summer training schedule is the answer to the problem, mainly because many students work during the summer for tuition money, etc., which at my school, for example, is $150 more than the proposed $1,100 stipend.

The AFROTC presently does serve a useful purpose in that it provides a means by which the otherwise dis-

*(Continued on following page)*

# LONG RANGE INPUT / 1794

News of the recapture of Condé from the Austrians was sped to the French Revolutionary Convention at Paris in a matter of minutes via Claude Chappe's amazing télégraphe aérienne, or relay aerial telegraph, Sept. 1, 1794. A new era in rapid communications had begun.

Today, instantaneous and completely reliable Electronic Communications insure the immediate and continuous interchange of intelligence throughout the Free World. ECI is proud of its initiative and responsibilities in the design, development and manufacture of high precision electronic equipment to the critical specifications required in various aerospace and surface roles vital to our National Defense and to scientific achievement. An example is ALRI—Airborne Long Range Input—a program where ECI communications and data link equipment fill an integral and essential requirement in linking USAF's advanced early warning system to SAGE—our continental defense network.

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interested student might become acquainted with the Air Force. Its very propinquity to the student body on campus does this. One thing that might be done is to make the campus AFROTC *more attractive*, thereby enticing more students from which the best of a larger sample might be selected for actual commissioning.

Christmas and Easter recesses, or a portion thereof, might be used for short trips to nearby Air Force bases, providing a glimpse of Air Force life all too infrequently seen by cadets.

Peter A. Young
Fordham University
Bronx, N. Y.

### It's Still Flying High

*Gentlemen:* It was good to see the article on the Spaceplane by your J. S. Butz, Jr., which appeared in the January issue.

A lot of us had begun to think that the Air Force was so eager to compete with Buck Rogers and Redstone as to forget that it had wings.

T. B. Holliday
Elmhurst, Ill.

### Help from Squadron

*Gentlemen:* We have just received an order for 110 copies of the "Arithmetic of Flying" from the San Diego Squadron of the Air Force Association.

The letter says: "Our Squadron plans to present these to local schools and make copies available to interested persons."

This kind of activity not only reflects credit on your Squadron, but it gives other Squadrons a hint of things they can do which will be helpful to them, to their schools, and of course, helpful to us.

Evan Evans, Executive Director
National Aviation Education Council
1025 Conn. Ave., N. W.
Washington 6, D. C.

### WW II and Korean War Histories

*Gentlemen:* The Air Force Academy Library is interested in obtaining published unit histories from Air Force units in World War II and the Korean War. Since many of these histories were distributed only to unit members, they are not available on the regular book market. Any present or former Air Force members wishing to donate copies of these histories for use by Academy Cadets and faculty are urged to write to the Director of the Library, United States Air Force Academy, Colorado, for mailing instructions.

Lt. Col. George V. Fagan
United States Air Force Academy
Colorado

SPERRY

A highly sophisticated long range tracking and acquisition radar has been designed and fully developed by Sperry. The advanced capabilities of this new shipboard design provide the breakthrough in instrumentation radar required for advanced missile and space programs. While its performance parameters will not be discussed here, qualified persons are invited to communicate directly with the Marketing Manager of the Division.

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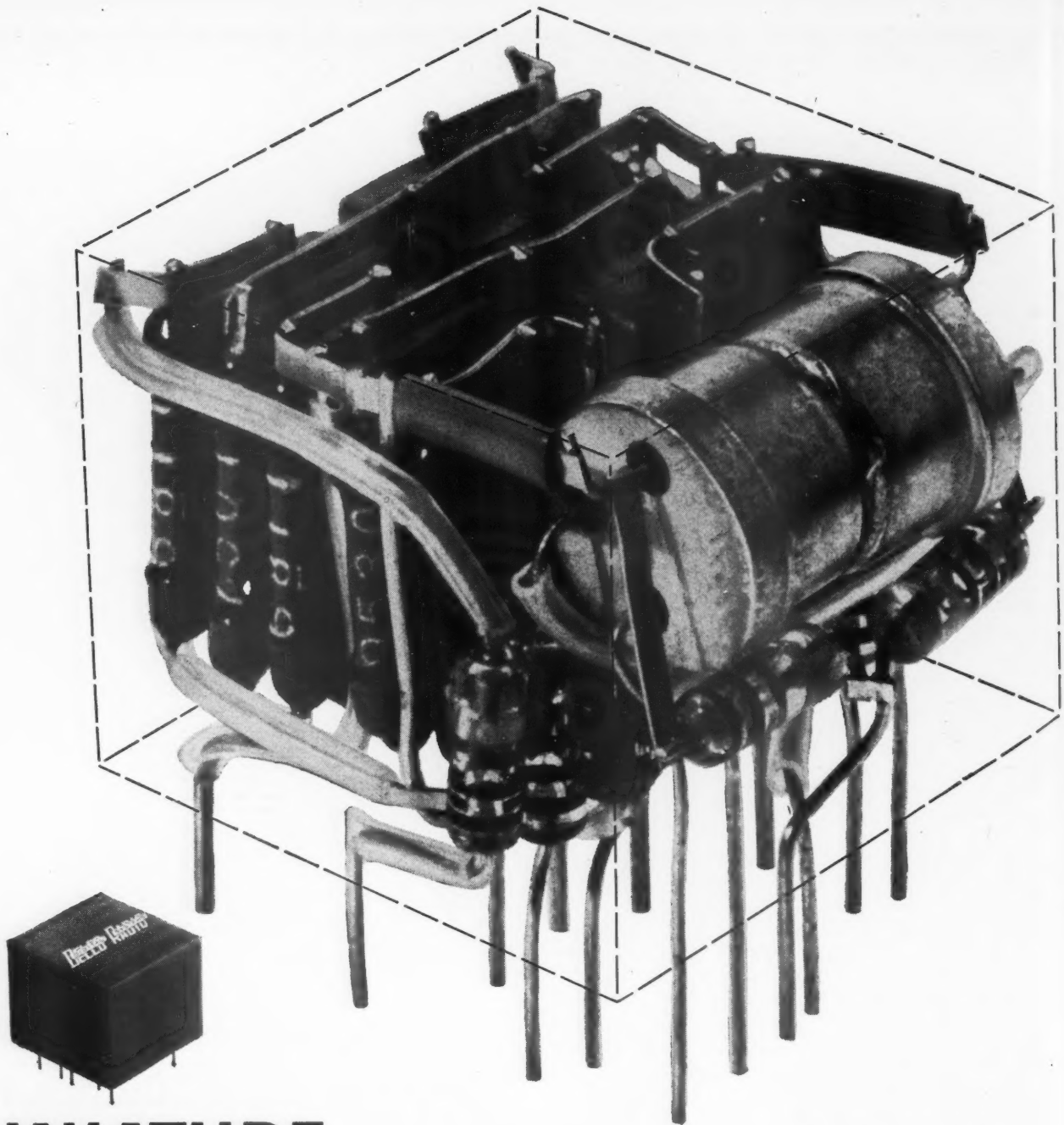

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# What's New With ★ RED AIRPOWER

*Here's a summary of the latest available information on Soviet air intelligence. Because of the nature of this material, we are not able to disclose our sources, nor document the information beyond assurance that the sources are trustworthy.*

An explosive expansion of **scheduled helicopter service** is in progress in the Soviet Union. **Aeroflot,** the state-owned airline, maintained **sixty scheduled helicopter routes** during 1960. Under current plans, it will add 140 new routes this year.

In US terms, these Soviet figures are slightly misleading because the **Russian definition** of scheduled service **differs somewhat from our concept** in this country. Many Soviet routes are operated on a **seasonal basis.** Service on all of them is **adjusted rapidly** to meet changes in passenger volume.

Most of the new helicopter routes are located in the **southern part of the USSR** to accommodate the ever-increasing crowds of **summer vacationers.** The routes run primarily from **city centers and commercial airfields** to **resort areas.** The Black Sea beach resorts and the mountain areas in Georgia and near Tashkent are among those which will receive new helicopter service. New routes also will be opened in the **Soviet Far North** and in **Siberia.**

The equipment on the vast majority of the new routes will be the old standby **MIL-4** which is about the same size as the **Sikorsky S-58** and can carry **ten passengers** and some cargo for **250 miles.** The piston-engined MIL-4 has proved to be by far the **most popular Soviet helicopter** with crews and operating agencies alike. It has been used widely in all areas behind the Iron Curtain and has been sold in **Austria and India.** Aeroflot flies MIL-4s by the hundreds. They are in use at civil airfields all through the Soviet Union.

Russian helicopters are employed for **crop dusting** and most of the industrial uses that have become commonplace in the US. This **industrial and farming activity** is handled by Aeroflot aircraft and crews under **"contract arrangements"** to large collective farms, manufacturing enterprises, and local governments.

Only **three types of helicopters** are receiving much use by Aeroflot other than the MIL-4. These are the **MIL-1, the KA-15, and the KA-18.** The four-place, single-rotor MIL-1 is very well thought of. The Kamov-15 (two-passenger) and -18 (four passenger) aircraft are the only successful helicopters in the world with **coaxial rotors.** They are operated in **much smaller numbers** then the two MIL designs and are used primarily for such purposes as **crop dusting and ambulance duty.**

Aeroflot has a few **YAK-24 twin-rotor, twin-piston-engine helicopters** which can carry up to **forty passengers.** Design of the first YAK-24 models began around 1952 and the aircraft has been in production for five years or more. It originally had a **fabric-covered, tubular fuselage** and has progressed to **sheet-metal construction** with larger, more efficient rotor-blade design. Some of them have been given **very plush interiors** by Russian standards, indicating that they are used as VIP aircraft. Improvements are still being made in the YAK-24. Most of those produced have gone and are **going to the military.**

The giant, **twin-turbine, single-rotor, eighty-passenger MIL-6** helicopter has not reached operational status with either the Red Air Force or Aeroflot. It was **first shown about two and a half years ago.** This exceedingly ambitious aircraft is a good example of Soviet emphasis on and belief in the value of helicopters regardless of high operating and development costs. While no turbine helicopters other than the MIL-6 have been shown, it has been reported repeatedly that a **new turbine helicopter** using the proven MIL-4 rotor system is under development.

* * *

**A passenger-carrying ground effect machine,** or ground-level vehicle supported by an "air-cushion," is **under development** by the Russians at Leningrad. The main design objective of this vehicle is to **provide more economical river transportation** than either the displacement craft or hydrofoil boats now in use. Little effort is being expended to give it the capability to cross rough country. Several schemes are still being studied to provide the **most stable air cushion** at all forward speeds. The top speed of this ground effect machine will be somewhere between **thirty and fifty miles per hour.**

* * *

The **Antonov AN-14**—Little Bee—six-passenger feeder airliner is about a **year and a half late** in entering Aeroflot service. This aircraft is intended to **connect sparsely settled areas** in Siberia and Asiatic Russia with main Aeroflot routes. The original development scheduled for the AN-14 called for it to have come out of flight test in the **middle of 1959.** It was to have entered operational service shortly thereafter.

* * *

The development of **two new low-power, long-range, lightweight sports aircraft** has been announced by the Soviets. They are the **KhAI-17,** a ninety-mile-per-hour pusher weighing 770 pounds and powered by a thirty-horsepower engine, and the **KhAI-18** which weighs 1,100 pounds, has a 125-mile-per-hour top speed, and a range of better than 1,800 miles.

* * *

The Russians are **claiming success** in the program to **increase the practical working strength of glass** which until recently has been **less than one percent** of the theoretical strength. According to an announcement by **A. Orlov,** Chief Specialist of the State Committee for Automatization and Engineering, a treatment has been developed to increase the strength of ordinary glass **by five times** and to improve **its high-temperature performance.** The new materials are supposed to be **harder than high-carbon steel,** lighter than **aluminum,** have a strength-to-weight ratio **1.5 times better than the best steel alloys,** and withstand **1,800 degrees Fahrenheit** temperature with some of them able to resist 2,700 degrees.

Some of the methods which have been experimented with by the Soviets to strengthen properties of glass are **spraying with chemicals** at moderate temperatures to **close tiny cracks** that are almost impossible to get rid of by other means, treatment with **various types of radiation** to try to increase the structural density, and the use of a **wide variety of additives** or alloying elements including organic molecules.—END

*THE AIR FORCE ASSOCIATION CORDIALLY INVITES*

*YOU TO ATTEND THE 15th ANNUAL*

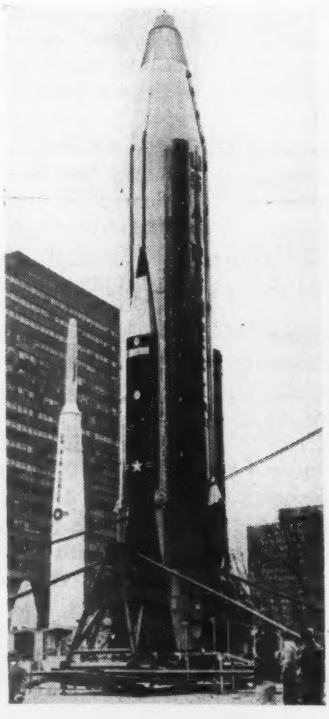
# NATIONAL CONVENTION AND AEROSPACE PANORAMA

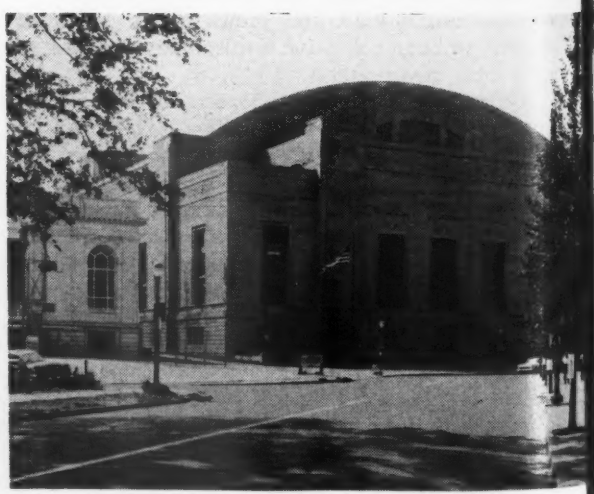
*IN PHILADELPHIA, SEPTEMBER 20-24, 1961*

**Philadelphia is a city with a "new look." Above, impressive view from City Hall.**

## GENERAL INFORMATION

You'll find listed on page 19 the names and rates of the official hotels and motels for the Air Force Association's 1961 National Convention and Aerospace Panorama, to be held in Philadelphia, September 20-24. Headquarters for the Convention and Panorama will be at Philadelphia's Convention Hall, where registration, major meetings, and banquets will be held. The AFA business sessions will be at the Sheraton Hotel. All of the hotels and motels are within ten minutes by cab of the Convention Hall. All of the motor hotels listed on page 19 are new. Additional motor hotels and lower-rate hotels are available on request.





**Above, Philadelphia's Convention Hall, which will be headquarters for National Convention, Panorama.**

**Left, a recent display of aerospace weaponry at Reyburn Plaza near the Philadelphia City Hall.**

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**Okinawa-Formosa Signal Corps Communication Link Completes Pacific System** Spanning 400 miles of water, the Far East Scatter System, operated by the Signal Corps, is a highly reliable link in the important Trans-Pacific Scatter System. Alpha personnel engineered the Far East system and provided all site preparation, roads, buildings, antennas . . . as well as the Collins tropospheric scatter equipment. Construction of the stations joining the significant outposts of Okinawa and Formosa took place under the severe topographic and weather conditions of the typhoon-prone Pacific. Field personnel from Alpha are now working side by side with Signal Corps technicians operating this vital multi-channel voice, teletypewriter and data communication link.

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### RESERVATION PROCEDURE

AFA has established a Housing Office at the Philadelphia Convention Bureau to handle all requests for rooms and suites for the Convention and Panorama. Requests will be confirmed on a first-come basis. ALL requests for rooms and suites must be sent to the AFA Housing Office in Philadelphia at the address shown on the reservation form. Be sure to list THREE choices of hotels or motels, your arrival DATE and HOUR, and your departure date. The number of rooms and suites allocated at any one hotel to any individual or company will be limited by necessity. If you plan to arrive after 6:00 p.m., your reservation request must be accompanied by a guarantee of payment.

### AFA HOTELS, MOTOR HOTELS, AND RATES

| HOTEL | Single | Twin & Double | 1 b/r Suite | 2 b/r Suite |
|---|---|---|---|---|
| Adelphia | $ 6-10 | $14-18 | $25-35 | |
| Barclay | $16-21 | $16-21 | $30-36 | $54-60 |
| Bellevue Stratford | $10-17 | $14-23 | $32-60 | $52-80 |
| Ben Franklin | $ 8-12 | $11-18 | $30-35 | $45-53 |
| Drake | $12.00 | $14-18 | $24.00 | |
| John Bartram | $ 6-12 | $ 9-16 | $20-25 | $40.00 |
| Sheraton | $10-14 | $16-18 | $35-45 | $42-68 |
| Sylvania | $8.00 | $12-15 | $28.00 | |
| Warwick | $12-15 | $16-21 | $32-42 | $52-80 |

| MOTOR HOTELS | Single | Twin & Double | 1 b/r Suite | 2 b/r Suite |
|---|---|---|---|---|
| Cherry Hill Inn | $11-14 | $16-20 | $29-50 | $70.00 |
| Franklin Motor Inn | $12.00 | $16.00 | $26-32 | |
| Marriott Motor Hotel | $10-14 | $14-20 | $30.00 | $50.00 |
| Treadway Inn | $ 9-12 | $13-16 | $30.00 | |

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**PHILADELPHIA 2, PENNSYLVANIA**

**Be sure to list *first*, *second*, and *third* choices of hotels and arrival DATE and TIME. If room is not available at rate requested, next nearest available rate will be assigned. For arrivals after 6:00 p.m., reservation requests MUST be accompanied by a WRITTEN GUARANTEE OF PAYMENT.**

**HOTEL RESERVATION FORM • 1961 AIR FORCE ASSN. CONVENTION**
**Philadelphia, Pennsylvania • September 20-24**

*TYPE OR PRINT*

Date_____

Name_____ Rank, if Military_____

Firm/Organization_____

Mail Address_____

City & State_____

1st Choice Hotel _____ 2nd Choice Hotel _____ 3rd Choice Hotel

Type of Room—Be specific for double or twin room. _____ Desired Rate

Others Sharing Room

Arrival Date and Hour _____ Departure Date

*NOTE:* **For arrivals after 6:00 p.m., reservation requests must be accompanied by a written guarantee of payment.**

3-61

*News,*
*Views*
*& Comments*

# AEROSPACE WORLD

**Frederic M. Philips**
ASSOCIATE EDITOR, AIR FORCE MAGAZINE

The two young Air Force officers stepped from their Globemaster, saluted President Kennedy, kissed their wives. One turned, warmly embraced his mother and father. Air Force Secretary Eugene Zuckert, Chief of Staff Gen. Thomas D. White, and other dignitaries stepped forward and greeted them.

Capts. Freeman B. Olmstead and John R. McKone, survivors of an RB-47 shot down by Red fighters over international waters north of Russia last July 1, were home. The plane had been on an electronic reconnaissance mission. Most of the period of captivity after being picked up by the Russians was spent in Moscow's Lubyanka Prison. On January 24, in a gesture to the new US Administration, the Russians freed the flyers. President Kennedy announced their release at his first press conference on January 25.

Two days later the Globemaster bearing the two captains put down at Andrews AFB, Md., to set off a VIP welcome. The aviators and their party were guests at tea that afternoon at the White House. The next day they headed back to their home base, Forbes AFB, Kan.

Washington Evening Star photo by Paul Schmick

**Presidential welcome at Andrews AFB, Md., for USAF flyers imprisoned by Reds. Capt. John McKone kisses wife, Capt. Freeman Olmstead turns to his parents.**

So ended another episode in the cold war. Unfortunately, it had come to a close far less happily for the other four members of the RB-47's all-officer crew. The Russians returned the body of the plane's pilot, Capt. Willard G. Palm, last summer. He was buried with honors at Arlington Cemetery. Bodies of the three others —Maj. Eugene E. Posa, Capt. Dean B. Phillips, and Capt. Oscar L. Goforth —presumably were never found.

Just prior to the airmen's release, a Russian magazine published a report on eleven crewmen of a USAF C-130 transport gunned down in the Soviet-Turkish border area in September 1958. The bodies of six airmen aboard the plane were handed over to US authorities three weeks after the incident. Whereabouts of the other eleven men aboard has been a mystery since.

Now an article in the Soviet magazine *Ogonek* reported that the eleven men parachuted to the ground and were captured. The article gave no further information on the fate of the eleven or where they were at present. The State Department announced in Washington that it was seeking "clarification" from Russia of questions raised in the article.

The US charged after the plane was downed that a phony Russian navigational beam had lured it across the Red border. Early in 1959, the State Department released a tape recording of the radio conversation of five Russian pilots engaged in attacking the unarmed US craft. Soviet Deputy Premier Anastas Mikoyan, visiting this country at about the same time on a trade mission, told US government officials and newsmen that he had no information on the subject.

☆

This was, once again, a month of achievements. **Minuteman,** the Air Force's second-generation, solid-propellant ICBM, successfully roared 4,200 miles down the Atlantic Missile Range in its first test firing. The Convair **B-58 Hustler** racked up a handful of new records. The US rocketed a chimpanzee named **Ham** into space out over the Atlantic and recovered it safely. USAF put into orbit a developmental model of its Samos reconnaissance satellite, **Samos II.**

★ Minuteman made a spectacular debut. The fifty-eight-foot missile, potentially the central weapon in our

deterrent arsenal, landed on target in the South Atlantic some twenty minutes after launching from Cape Canaveral on February 1. It was the first time in the history of US space shots that three untested stages of a missile were tested in the same launch. All worked perfectly. Minuteman, with its solid fuel, will provide true split-second readiness when it becomes operational. It will be able to sit in its silo storage launcher for months, then go at the press of a button should the need arise. It does not require time-consuming fueling before launch like present-day liquid-fuel missiles. The solid fuel is of course the key to Minuteman mobility as well.

★ A B-58 broke six closed-course speed-payload records in the vicinity of Edwards AFB, Calif., on January 12. Five of them were held previously by the Soviet Union. Two days later, on January 14, a second B-58 proceeded to break three of these newly established marks. B-58 number one, piloted by Maj. Henry J. Deutschendorf, Jr., set these records for 1,000 kilometers (about 621 miles):

1. Speed with no payload, 1,200.-194 miles an hour. Previous record was 700.47 mph by an Air Force F-101 in April 1959.

2. Speed with 1,000-kilogram payload (about 2,200 pounds), 1,200.194 mph. Previous Russian record was 639.18 mph set October 1959.

3. Speed with 2,000 kilograms (about 4,400 pounds), 1,200.194 mph. Previous Russian record was 639.18 mph set October 1959.

Records set for 2,000 kilometers (about 1,242 miles) were:

4. Speed with no payload, 1,061.-808 mph. Previous record 596.47 mph set by a Russian TU-104 in April 1960.

5. Speed with 1,000-kilogram payload, 1,061.808 mph. Previous record same as TU-104's above.

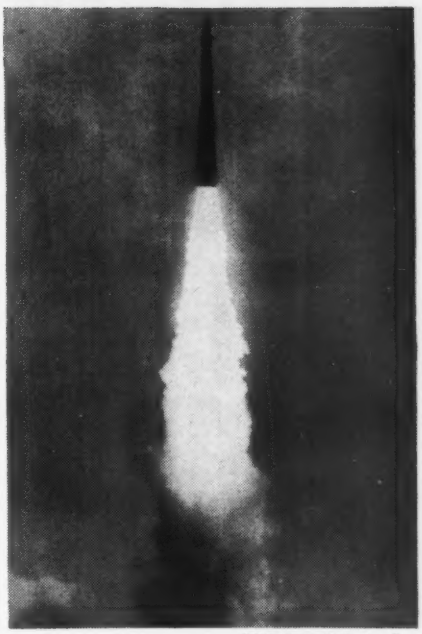
6. Speed with 2,000-kilogram payload, 1,061.808 mph. Previous record same as TU-104's above.

B-58 number two, piloted by Maj. Harold E. Confer, two days later moved to even newer frontiers in the 1,000-kilometer payload categories with a speed of 1,284.73 mph with no payload, 1000 kilograms, and 2,000 kilograms.

★ Ham the chimp had his ride on January 31, the day before the Minuteman firing. The National Aeronautics and Space Administration sent the little thirty-seven-and-one-half-pound ape up in a McDonnell-manufactured Project Mercury man-in-space capsule. The boost job was accomplished by an Army-developed Redstone rocket. An overshot sent the capsule 420 miles downrange, more than 100 miles past the intended target area where a fleet of planes and ships waited to recover the capsule. A Marine helicopter hooked the capsule from the sea and deposited it aboard a Navy amphibious ship to begin the journey back to the Cape. Ham seemed to take the space journey, which reached an altitude of 155 miles over the Atlantic, very well. Next step in man-in-space development was slated to be a similar ballistic shot some months hence with a man instead of a chimp aboard.

In this connection, Russia on February 4 sent up a large seven-ton satellite, heaviest space shot yet, in pursuit of its own Ivan-in-space program. The new Sputnik, experts were quick to point out, was easily large enough to hold one or two men or animals. But the Russians did not immediately indicate whether the satellite carried either astronaut or astrobeast.

★ Samos stands for Satellite and Missile Observatian System. When perfected, Samos satellites should be able to radio back reconnaissance photographs of almost any point on the earth's surface. Samos II, a step toward an operational satellite with this vital attribute, entered orbit after an Atlas ICBM boost from the Navy-operated Point Arguello, Calif., space base on January 31. Samos II took test photographic equipment aloft. Samos I failed to attain orbit after launch at Point Arguello last October 11.



Wide World Photos, Inc.

**Minuteman ICBM scores blazing success in launch at Cape Canaveral, Fla., on February 1. It was first shot for Air Force's second-generation missile, an important addition to the US arsenal.**

Wide World Photos, Inc. from the U. S. Air Force

**B-58 set six world payload-speed marks January 12. Second B-58 broke three of them January 14. Above, crew of second plane: systems operator Capt. H. S. Bialas, pilot Maj. H. E. Confer, and navigator-bombardier Maj. R. H. Weir.**

☆

The sighs of relief came from men (and women) in uniform and their dependents.

The boom had, late in November, been directed to fall on service families. Outgoing President Eisenhower had ordered urgent action on several fronts to meet a continuing US loss of gold in dealings with other nations. The services were ordered to cut the number of authorized dependents overseas from 484,000 to 200,000 by August 1, 1962. The Air Force, with 205,000 of the over-all number of dependents overseas, would have had to decrease its number of such dependents by 6,120 a month during this period. Some of the overseas depend-

*(Continued on page 23)*

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*How to find economical and practical answers to exotic problems is the 24-hour-a-day job of the advanced technologists of Systems Management Division, Western Gear Corporation.* ■ *Look at these recent proposals prepared by Systems Management Division:* **HOW TO** *level mountains of ice to make airport runways.* **HOW TO** *collect and return lunar soil samples for analysis.* **HOW TO** *stabilize a submarine to provide a missile-firing platform.* **HOW TO** *devise a power transmission system for a high-speed, ocean-going hydrofoil craft.* **HOW TO** *transmit high HP and high speed by other than present known methods.* **HOW TO** *use plasma flame technique to produce self-supporting shapes from refractory metals such as small tungsten tubing and nozzle inserts.* **HOW TO** *build multi-frequency resonant antennae without loading coils.* **HOW TO** *operate gears in radiation atmosphere at high temperatures without lubrication.* **HOW TO** *use new techniques in measuring jet engine temperatures.* **HOW TO** *televise and photograph ocean bottom at 500 fathoms.* **HOW TO** *measure residual stresses under 1/2 million PSI.* ■ *Or, what have you? Entrust your exotic problems to the creative imagination and laboratory skills of the advanced technology experts of Systems Management Division. A collect phone call or wire will get you one step closer to the solution of your problem.* ■ *Western Gear Corporation, Systems Management Division, P.O. Box 192, Lynwood, California. Telephone NEvada 6-0911.*

W SYSTEMS MANAGEMENT DIVISION

ents were apparently slated to return to the States ahead of the uniformed members of their families. Others would not accompany the family breadwinner-fighting men when they went abroad.

Then, before the dependents could start rolling home, all bets were off. At his second news conference on February 2, President Kennedy announced that "restrictions recently imposed on travel abroad of dependents of service personnel will be lifted as soon as the necessary detailed requirements can be worked out in the Defense Department." Noting that US military leaders feared the dependent action would lower morale and the reenlistment rate, Mr. Kennedy said the hope was "that other savings can be made which will be more satisfactory to us and to the position of the armed forces." The following week the new Administration made public an across-the-board plan to combat the "gold gap." It let the dependents off scot free.

A few days later, Secretary of Defense Robert S. McNamara told newsmen that overseas military personnel and dependents would be asked to keep their expenditures of US dollars reasonably in check.

☆

These were among other major developments in electric-charged, new-Administration Washington:

President Kennedy told Congress in his State-of-the-Union address that both airlift and missile capabilities would be beefed up. "Only when our arms are sufficient beyond doubt can we be certain beyond doubt that they will never be employed," he said. In a subsequent press conference, Defense Secretary McNamara announced that USAF orders were being placed for fifty-three new transports including thirty jets. First deliveries, he said, were expected in July. The thirty jets were to be Boeing C-135s, the remainder Lockheed C-130s, transports.

Highlight of Mr. McNamara's press conference was the announcement that he had decided to streamline the civilian hierarchy at the Pentagon to an extent. Senator Stuart Symington's reorganization plan presented to the new Administration some months ago recommended a major modification along these lines. Mr. McNamara said he was abolishing two Assistant Secretary of Defense posts, merging their past functions with two of the five remaining assistants' offices. The tasks of the Health and Medical assistant's office went to the Assistant Secretary for Manpower, Personnel and Reserve. The Properties and Installations office was being merged with the Office of the Assistant Secretary for Supply and Logistics. Mr. McNamara said, in this connection, that a new Pentagon office was being created to handle reorganization and management matters. To be called the Office of Management Planning and Organization Studies, it was to be headed by the Defense General Counsel, Cyrus Vance.

The new Defense Secretary also made clear Administration policy on public statements by military chiefs. He said that full and frank expression of views within the Pentagon organization was expected. But once a decision was reached, he said, it was to be backed "publicly and otherwise." The exception to this rule would be when military leaders appear before Congress, he said. Mr. Kennedy had already indicated that the Administration intended to take a careful look at addresses by military leaders before they were delivered. He told newsmen that this review would be in line with "the general objectives of American foreign policy" and "national security." Already affected had been speeches by USAF's Chief of Staff, Gen. Thomas D. White, and the Chief of Naval Operations, Adm. Arleigh Burke.

Appointments to top governmental posts came in rapid fire order through the month. Among officials named:

Assistant Secretary of Defense (Comptroller) **Charles J. Hitch.** Mr. Hitch was chief of the research council of the RAND Corporation, author of a widely used textbook, *Economics of Defense in the Nuclear Age.*

Assistant Secretary of Defense for Installations and Logistics **Thomas D. Morris,** who served in a number of DoD posts in the past and was consultant to the Hoover Commission for government organization.

Assistant Secretary of Defense for Public Affairs **Arthur Sylvester,** veteran news correspondent in Washington for the Newark, N. J., *News.* He will be DoD's primary news spokesman. Working as his deputy will be **Nil A. Lennartson,** who was special assistant to Air Force Secretary Symington in 1948 and has held several government positions since.

Assistant Secretary of Defense for

*(Continued on page 25)*

U. S. Army L23D produced by Beech Aircraft—equipped with AN/APQ-86 all-weather, high resolution reconnaissance radar, developed and built by TI in cooperation with the U. S. Army Signal Corps.

TI IN SURVEILLANCE SYSTEMS

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# Building block concept for very large solid boosters successfully demonstrated

United Technology Corporation has successfully completed the firing of a series of flight-weight conical, segmented solid propellant rockets – one phase of a study being conducted for NASA.

The use of conical segments makes possible the fabrication of very large solid rockets at lower cost, significantly reduces handling and manufacturing problems.

With the successful demonstration of UTC's building block concept, current technology can now provide solid booster thrusts exceeding any known to exist in the world.

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Conical, segmented solid propellant rocket pictured during one of a series of successful firings at UTC's multi-million-dollar Development Center in the San Francisco Bay Area. The UTC rocket, with minor adaptation, is ready for immediate use as an operational vehicle.

Manpower, Personnel, and Reserve **Carlisle T. Runge.** Mr. Runge was a member of the University of Wisconsin law faculty and formerly assistant US attorney for the western district of Wisconsin.

Secretary of the Army **Elvis Stahr,** who was president of the University of West Virginia.

National Aeronautics and Space Administration Administrator **James E. Webb.**

DoD Advanced Research Projects Agency Director **J. P. Ruina.**

Federal Aviation Agency Administrator **Najeeb Halaby.**

Civil Aeronautics Board Chairman **Allen S. Boyd.**

President Kennedy also announced selection of USAF's **Col. Godfrey T. McHugh** as his Air Force aide. He had been deputy chief of the Long-Range Objectives Group, Headquarters USAF. Colonel McHugh is a qualified jet aviator, has the additional qualifications of speaking fluent French and Spanish. He was educated in Paris and at Columbia University. An enterprising Washington newspaper marked his selection by digging from the files a several-years-old photograph of Colonel McHugh and a young lady on a date. She was then Miss Jacqueline Bouvier. Now she is the nation's first lady—the boss's wife.

☆

"On the occasion of your fifteenth anniversary, I salute your achievements. Your work over these incredibly short fifteen years has been important to the nation and the Air Force, which needs your continuing support. Over the fifteen years of your history, you have distinguished yourselves by many contributions to the public understanding of the role of airpower.

". . . The Air Force Association is a source of support even more important in the future than in the past, support based on knowledge, skilled analysis, and honest criticism aimed at improving the contribution of airpower to the national defense and security."

The words came from Secretary of the Air Force Eugene Zuckert in the major address at a dinner celebrating AFA's fifteenth anniversary. The dinner, attended by more than 500 guests including Senator Stuart Symington and Gen. Carl. A. Spaatz, first Secretary and first Chief of Staff respectively, was held at the Mayflower Hotel, Washington, on February 3. On hand to honor Secretary Zuckert and AFA was an impressive cross section of top government officials and military officers, senators, congressmen, and industrial executives. USAF's Chief of Staff, General White, and the Vice Chief of Staff, Gen. Curtis E. LeMay attended. President Kennedy sent a telegram noting AFA contributions to national strength.

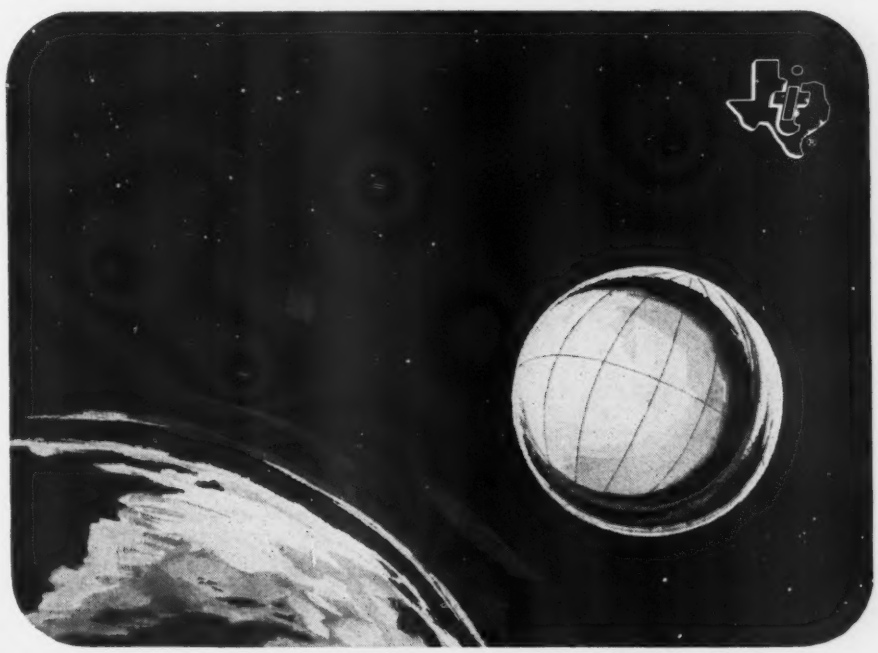
A program reviewing aerospace achievements through the past fifteen years was presented prior to Mr. Zuckert's remarks. Moving pictures, slides, and a commentary delivered by the evening's master of ceremonies, cartoonist and longtime AFA member Milton Caniff, traced the aerospace story from the dawn of the jet age to the X-15 rocket plane and the Minuteman missile. Air Force Association President Thos. F. Stack, sharing the microphone with Mr. Caniff, presented distinguished guests to the assemblage.

February 3, the day of the dinner, also witnessed one of the heaviest snowstorms of a snowy winter in the eastern United States. This was the one that piled some seventeen inches on New York City. Many notables, including distinguished Air Force officers who figured in the program, were unable to fly into Washington as a result. Among those snowed out was Eastman-Kodak executive Edward P. Curtis. Mr. Curtis, a World War II Air Force general and instrumental in the founding of the Air Force Association, had been slated to act as toastmaster at the dinner.

*(Continued on page 27)*

Wide World Photos, Inc.

**USAF Col. Godfrey T. McHugh was this month named President Kennedy's Air Force aide. He is a jet pilot, linguist.**



TI electronic flight control in Douglas Aircraft's Delta launch vehicle helped orbit the NASA communications satellite ECHO I.

TI FLIGHT CONTROLS IN SPACE EXPLORATION

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UNITED AIRCRAFT CORPORATION

**Sikorsky Aircraft Division**

*Stratford, Connecticut*

Wide World Photos, Inc.

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**Dinner marking AFA's fifteenth anniversary, honoring Air Force Secretary Eugene Zuckert, left in photo above, was held February 3 in Washington. With Secretary are Vice President Lyndon B. Johnson, aviatrix Jacqueline Cochran. Photo left catches Missouri Senator Stuart Symington, first AF Secretary, former Chief of Staff "Tooey" Spaatz wearing boots. It was snowing out—hard.**

ELSEWHERE IN THE AEROSPACE WORLD:

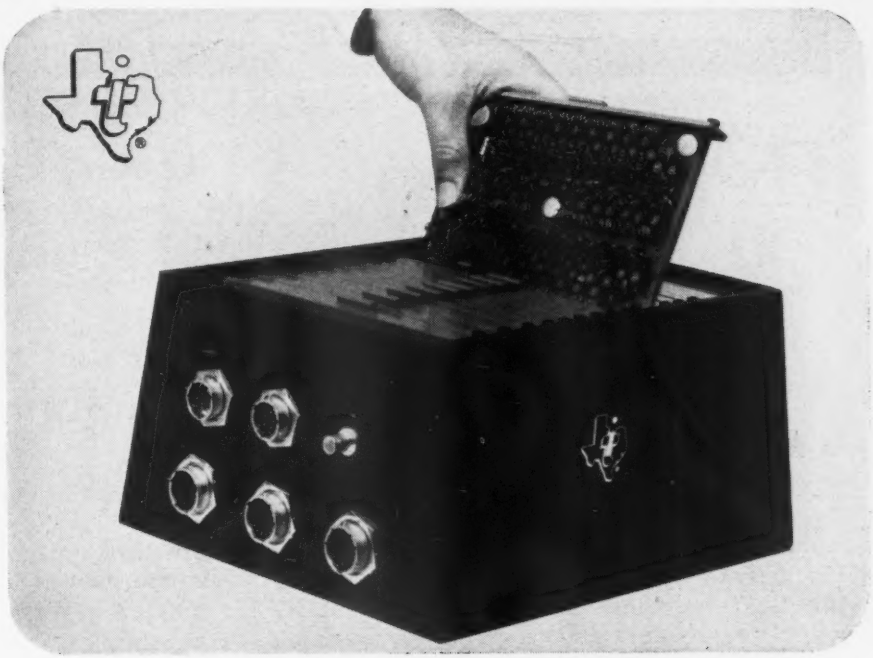
**Tragedy struck USAF's Texas Tower No. 4. The at-sea radar facility, off the Atlantic coast some eighty-five miles southeast of New York City, collapsed and disappeared among storm-tossed waves on the night of January 15. There were twenty-eight men aboard—fourteen Air Force personnel and fourteen civilian workmen. All perished. One body was recovered, one sighted but lost in an unavailing search-and-rescue effort following the disaster by USAF, Coast Guard, and Navy units. Twenty-six personnel were presumably trapped and drowned in the collapsed tower. Normal USAF complement of the tower was seventy men. Earlier storm damage caused reduction in the number of manning personnel; the civilian workers were aboard to effect repairs. The Air Force has two other Texas Towers, one off Maine and the other off Massachusetts, so designated because they resemble oil rigs used off the Gulf Coast. The service immediately established a board of inquiry to investigate the loss of Tower No. 4 and the men aboard her.**

Lt. Gen. Joseph H. Atkinson, Commander, Air Defense Command since September 1956, retired effective February 28. He was succeeded in command of ADC by his Vice Commander, Lt. Gen. Robert M. Lee. General Atkinson enlisted in the Army in December 1922, more than thirty-eight years ago. He became a flying Cadet at Brooks Field, Tex., a year later. During World War II, General Atkinson commanded heavy bombers in Europe and North Africa.

General Lee, who succeeds to command of ADC, previously served as Chief of Staff of UN and US forces in Korea, commanded TAC's Ninth AF at Shaw AFB, S.C., headed NATO's Fourth Allied Tactical Air Force and the Twelfth US Air Force in Europe. He was assigned as General Atkinson's ADC deputy in September of 1959.

**The Air Force adds a nineteenth major command with establishment of the Air Force Communications Service (AFCS) on July 1. The new command, with headquarters at Scott AFB, Ill., will during the following two years**

*(Continued on page 29)*



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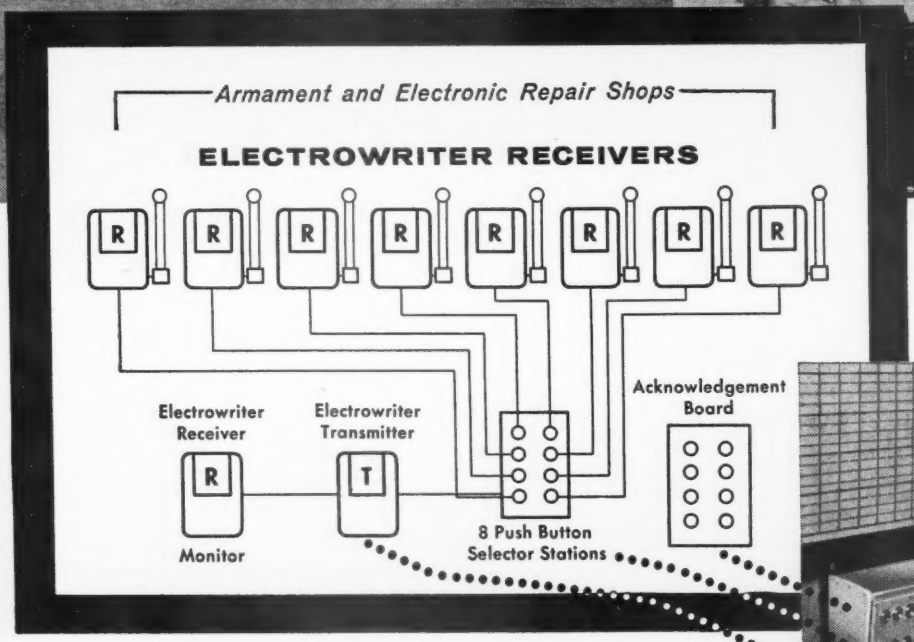


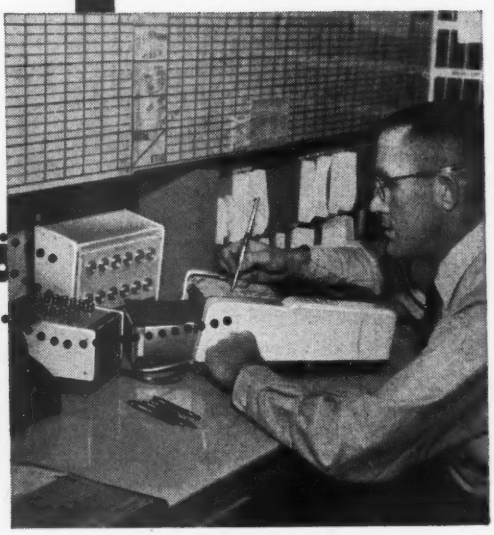

Dispatcher

# Here's how ADC *Says it in writing* AT HAMILTON AIR FORCE BASE

The Air Defense Command, Hamilton Air Force Base, cuts manpower and time in processing vital aircraft maintenance instructions through the use of Electrowriter Systems. Writing directly on an Electrowriter Transmitter, Central Maintenance transmits a description of the maintenance requested by an incoming aircraft. A pushbutton selector chooses the stations to receive the message. At Hamilton, there are nine receiving stations for Field Maintenance and eight receiving stations for Armament and Electronic services. Each shop concerned with the maintenance required receives the instructions instantaneously, *as they are written.*

The Electrowriter System combines the speed of the telephone voice with the accuracy of written instructions. Only one writing of the instructions is needed throughout the entire system. Speed and accuracy is increased and manpower is saved.

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**gradually assume responsibility for telecommunications point-to-point and air-to-ground on a global basis, as well as terminal and on-route navigational aids.**

SAC announced that B-52 combat-ready crews are now flying around-the-clock airborne alert training missions. All heavy bomber units were said to be taking part. Issues of airborne alert—when, why, to what extent, how much the cost—were at the center of military controversy at the highest level early last year.

**The "D" model of the Atlas ICBM bowed out on January 23 with an on-target shot down the Atlantic Missile Range. The shot was the forty-ninth in the Atlas test series. Thirty-five were judged successful. USAF and Convair, manufacturer of the Atlas, have begun checking out the more advanced Atlas "E." First three "E" shots suffered malfunctions after launch from the Cape, the most recent on January 24. An attempted Titan shot on President Kennedy's Inauguration Day, January 20, experienced a similar fate.**

Maj. Robert White, USAF X-15 pilot, took the rocket plane to 77,000 feet and Mach 3, 2,112 miles an hour, on February 7 as the North American X-15 flight program continued at Edwards AFB, Calif.

**A SAC B-52 carrying two unarmed nuclear weapons crashed north of Goldsboro, N. C., on January 24. Three crew members were killed. Five parachuted to safety. The plane was based at Seymour Johnson AFB, N. C. At the same time, newly released figures reveal that the Air Force had its safest flying year in 1960. Number of major accidents per 100,000 flying hours was reduced to 5.7 from 8.2 in 1959. The service's safety record has shown improvement year after year. SAC's flying safety record in 1960 was also at a new low, 2.19 accidents per 100,000 flying hours.**

In Laos, see-saw, off-again on-again fighting between Communist rebel and government troops continued through the month. The government put into service four armed T-6 trainers and several helicopters from the US.

The nuclear-powered US Navy cruiser *Long Beach* will carry the Polaris IRBM, the first surface ship to be so armed.

**The retired Chairman of the Joint Chiefs of Staff, USAF Gen. Nathan F. Twining, was elected the vice chairman of Holt, Rinehart and Winston, New York textbook publishers.**

**Republic Aviation, manufacturer of the World War II P-47 Thunderbolt fighter, has requested that men who flew the famed aircraft in the war and are interested in celebrating its twentieth anniversary get in touch with the company at Farmingdale, Long Island, N. Y. The concern tentatively plans to sponsor a get-together in May.**

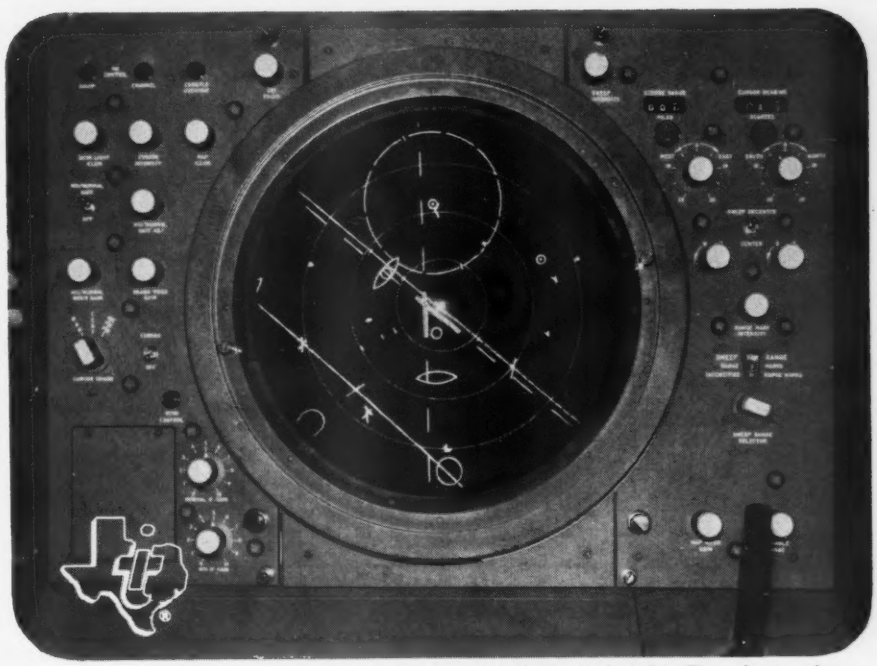
Photo by Robert Strobell

**Retired USAF Lt. Gen. Elwood R. "Pete" Quesada, outgoing Federal Aviation Administrator, received AFA Schilling Award for his distinguished service.**

☆

**STAFF CHANGES. . . . Maj. Gen. Alfred F. Kalberer,** from Vice Commander, to Assistant to the Commander, CONAC, Mitchel AFB, N. Y. . . . **Brig. Gen. Loren G. McCollom,** from Commander, Detachment 4, ADC, (4608 Support Squadron), Laurence G. Hanscom Field, Bedford, Mass., to Chairman, Joint Command and Control Development Group, Hq. USAF, Washington, D. C. . . . **Maj. Gen. Glen W. Martin,** from Director of Plans, DCS/P-P, Hq. USAF, to Military Assistant to the Secretary of the Air Force, OSAF, Washington, D. C. . . . **Maj. Gen. Ernest Moore,** from Commander, 3d AF, USAF, APO 125, N. Y., to Acting Vice Commander, ADC, Ent AFB, Colo. . . . **Maj. Gen. Sory Smith,** from Commander, 6th AF Reserve Region, CONAC, Hamilton AFB, Calif., to Chief of Staff, Hq. TAC, Langley AFB, Va. . . . **Brig. Gen. Paul W. Tibbets, Jr.,** from Commander, 6th Air Division, SAC, MacDill AFB, Fla., to Director of Management Analysis, Air Force Comptroller, Hq. USAF, Washington, D. C.

RETIRED. . . . **Maj. Gen. Richard H. Carmichael.**—END

Ground clutter is eliminated by TI moving target indicator shown with video map at 20-mile range.

TI IN HEAVY RADAR SYSTEMS

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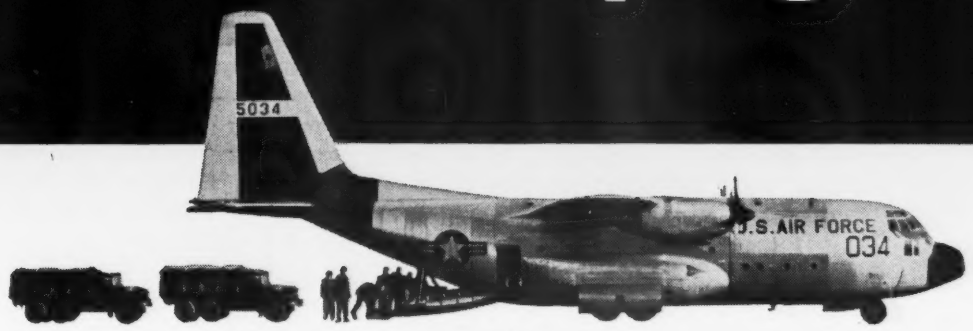
**The call came from the United Nations.** Within hours, huge airlifters were rushed to the Congo with hundreds of U.N. peace troops and tons of supplies. The Congo is a clear case in point why the free world must have hundreds of airlifters ready and able to go anywhere, any time — to a little war, a remote hunger spot, or for support of full-scale strategic retaliation. In Africa, and in more than three years of Air Force service, one big bird has proved ablest: the C-130 Hercules airlifter, made by LOCKHEED GEORGIA. The versatile C-130 is now operating, or being built, in 12 different configurations for the U.S. Air Force, Navy, Marine Corps, and Coast Guard—and for the air forces of several other free nations.

# Urgent!
# Send big birds and helping hands

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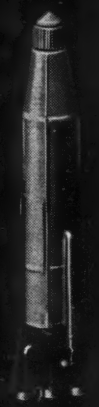

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In short, SCATE delivers 1) flexibility, 2) complete solid-state modularization, 3) fault isolation, 4) self-testing. Literature on request.

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# AIRPOWER in the news

**Claude Witze**
SENIOR EDITOR, AIR FORCE MAGAZINE

## How to Make a Headline

WASHINGTON, D.C.

We have a President who goes out, hatless, for a stroll. He drops in on newspapermen for dinner and runs across the street to see a movie. He has thrown his prestige into a fight in the House of Representatives—the one over expansion of the Rules Committee—and has seen his side win by a narrow margin. He has told the American people he was staggered when he found out what trials we face in the next four years and warned them that "each day we draw nearer to the hour of maximum danger."

In the first three weeks of his Administration John F. Kennedy made almost as much news as the weather in Washington, which is doing well in this winter of '61. He has made a large number of decisions, but the snow storms and traffic jams still get more room in the newspapers. The decisions were started, for all practical purposes, in his State-of-the-Union address. There he promised to "reexamine and revise our whole arsenal of tools—military, economic, and political." This was promising, if for no other reason than the superior coordination in these areas that is being practiced so effectively by the Communists.

There were a lot of loose commentaries about the Kennedy message. It was compared, by one pundit or another, with Lincoln's Gettysburg Address, Churchill's appeal for blood and sweat and tears, and Franklin Roosevelt's warning about the fear of fear. The parallels were false, except for the implication that these bits of oratory in troubled times all had high literary merit. There are no problems ahead that Jack Kennedy thinks cannot be solved. But the margin of Sam Rayburn's victory—only five votes out of 429—in his fight to enlarge the House Rules Committee was just about the magnitude of the Democratic victory in the presidential election. And it probably was made possible by the fact that Mr. Kennedy himself stood up before a press conference and said Sam Rayburn was right. The fact that the press conference was being watched by a staggering television audience gave his words an electronic thrust that has not been equaled since FDR took to the radio for fireside chats. The demonstration was simple: It showed that the new President goes after what he wants. He has a lot more of this wintry ice to cross in the next four years that has not been greatly strengthened by this narrow vote. It will take careful skating.

Largely because the narrow victory in the first test shows there are stumbling blocks ahead for the new Administration, it is unfortunate that the public gets such fragmented information. There is a tendency to shift the spotlight from subject to subject. There are news stories, editorials, questions at press conferences, and commentaries from public officials. Each tends to deal with a particular facet of our nation's problem. Yet, it was clear from Mr. Kennedy's masterful address at the inauguration that he does not break things down into the problems of a missile gap *or* NATO's stature *or* America's current economic situation. He wants everyone to know, he said, that "we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe to assure the survival and success of liberty."

To prepare for this hardship, if it strikes, it is evident he knows we must prepare all fronts. These fronts are not all in the Department of Defense. They range the gamut of public affairs, from the balance of gold payments to information policies, from disarmament to the right of any person to go to any public school. The job, the President said, will not be finished in a hundred days or a thousand or in the life of his Administration.

In view of the fact that he wants to get started only after a thorough and competent survey of the situation, it is unfortunate that there have been a number of flaps, major and minor, that have been brought about from areas over which the President and his official family have no control. One example was in the farewell address of President Eisenhower, who warned against letting "the military-industrial complex . . . endanger our liberties" or allowing "domination of the nation's scholars by federal employment, project allocations, and the power of money." We stand in some peril, the retiring Chief Executive cautioned, "that public policy could itself become the captive of a scientific-technological elite." There were some sensible reactions to this, such as the observation of Walter Lippmann that Eisenhower never had a Secretary of Defense, until the last one, who was the intellectual equal of the professional soldiers he had to deal with. Also, there were bad reactions, particularly in the press.

Here there appeared a small wave of learned essays rehashing all of the irresponsible charges and insinuations that have been bandied around in congressional hearings for the past few years. There were headlines in the New York *Times* calling attention to such horrendous facts as: "Huge Sums Involved in Arms Contracts" and "Pentagon Is Friendly with Suppliers." The great danger, of course, is that an exercise of misdirected caution in this case could menace national security. Protection against the menace is simple. It is a responsibility shared by the Executive Department, Congress, the military, and—most important—industry itself.

The Eisenhower speech also resulted in a prediction, in a Chicago newspaper, that the biggest military dispute of the decade was about to erupt. Here the play was that the missile industry and the USAF high command were about to set strategic policy for the United States and that the evil man, in this case, was Gen. Thomas S. Power. The SAC chief, the report said, had told Navy members of his staff that he intended to do all the planning. The story was false and was promptly disavowed by the general. The biggest military dispute of the decade will have to be found somewhere outside of Omaha.

By far the most serious flap in these early days of the

*(Continued on following page)*

Kennedy Administration originated right in the Pentagon. It involved the missile gap—is it is or is it ain't?—and proved that Tom Stokes, now deceased, was right when he said there is nothing wrong with Washington news coverage that the newspapers themselves can't cure. The history of this situation probably starts with the selection of Arthur Sylvester, a veteran reporter formerly on the staff of the Newark *News*, as Assistant Secretary of Defense for Public Affairs. Mr. Sylvester is a sophisticated Washington correspondent, and there is sad irony in the fact that he got himself and his boss into trouble basically by assuming that he could assemble about twenty reporters in a room and vouch that they all were equally sophisticated. It was no secret twenty-four hours after the session that Robert S. McNamara, Secretary of Defense, had met with reporters for a "background" session on Pentagon affairs. It was Mr. Sylvester's concept that the meeting, requested by some of the Pentagon press corps, was for background purposes only. In his days as a reporter—and they ended only a month ago—this meant that there was no news headline coming out of this meeting.

It also meant that the reporter was free in the future to use what he learned, but he could not attribute the information to any place or persons. This eliminates even the common "authoritative spokesman" and "Pentagon sources." On the other hand, the background meeting gives the reporter a substantial advantage when he is writing to provide future headlines on future events. It gives him a chance, as many veterans express it, to "play God." The background conference is considered a favor to newsmen, although there are cases where it provided access to editorial columns for public officials with something in mind other than the reporter's education. This approach, for the launching of trial balloons or the garnering of press support on a public issue, is self-evident to any seasoned and objective reporter, and such background conferences soon lose their audience.

The McNamara conference was highly informal; it was a bull session and the first opportunity the Secretary had taken to get well acquainted with a small group of newsmen who are assigned to his office as a regular beat. With Deputy Secretary Roswell Gilpatric at his elbow, he talked of his recent two-day visit to Headquarters of the Strategic Air Command in Omaha. He discounted reports of alarming friction between USAF and Navy officers on duty with the Joint Strategic Target Planning Staff. He was highly impressed by the technical competence of the personnel at SAC Headquarters.

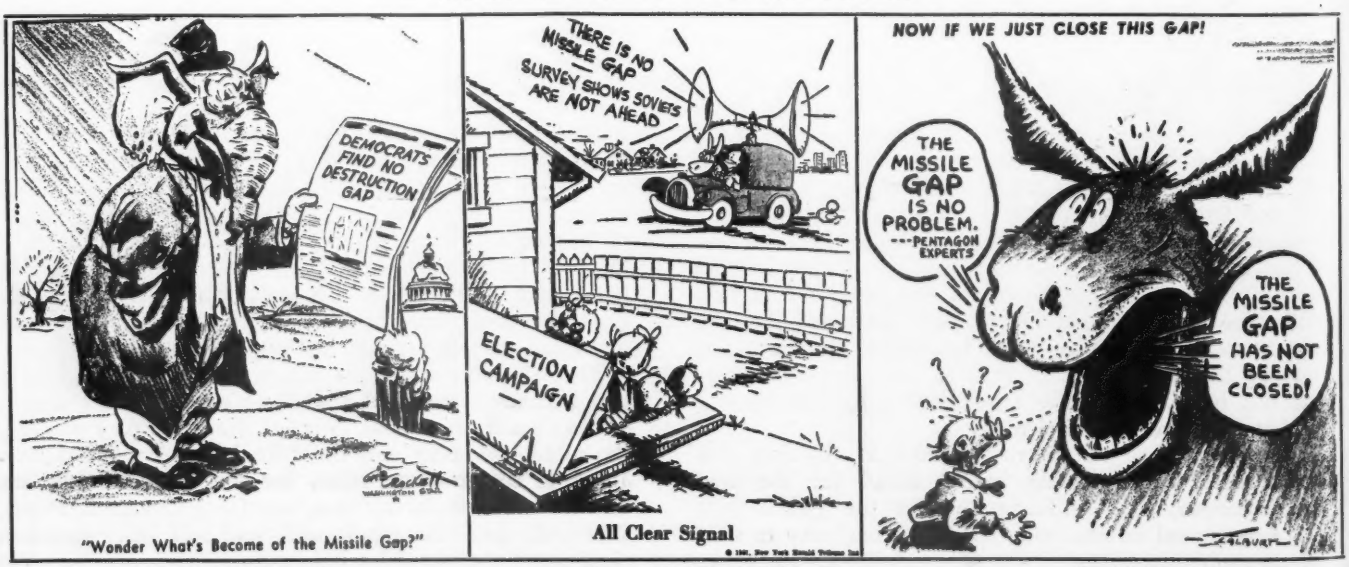
Queried about defense strategy, the Secretary placed emphasis on the "future of uncertainty." He finds he is facing, in his new job, a myriad of problems, another myriad of alternatives, and no sense of finality, after so brief a period in office. Despite all the unknowns, he said, he is confident that careful and calculated planning, buying as much time as possible to study all alternatives, will indicate the best available solutions. Preparing for the many contingencies of modern war, he is positive, is wasteful; but the waste can and must be minimized.

First steps toward the careful planning are being taken by four study groups, each composed of a mix of professional soldiers and civilians. The areas they are examining are strategic weapons, limited-war requirements, research and development, and bases and installations. This is a big job, and the Pentagon high command does not anticipate there will be an entirely new military theory developed in the twenty days allocated to the studies. But they do expect to get enough information to reappraise the Eisenhower defense budget. There are decisions that must be made; it is evident that some changes must be made, and failure to make the decisions is, in fact, making a decision in favor of the *status quo*. *Status quo* appears to be the lack of an integrated strategy, and the first goal of the Kennedy Administration is to seek one, making a clear decision prior to any attempt to revise the budget or plan a new one.

It was at this point that Mr. McNamara was asked for

*(Continued on page 39)*

## THREE LOOKS AT THE HEADLINES


DEMOCRATS FIND NO DESTRUCTION GAP
THERE IS NO MISSILE GAP — SURVEY SHOWS SOVIETS ARE NOT AHEAD
ELECTION CAMPAIGN
NOW IF WE JUST CLOSE THIS GAP!
THE MISSILE GAP IS NO PROBLEM. ---PENTAGON EXPERTS
THE MISSILE GAP HAS NOT BEEN CLOSED!

"Wonder What's Become of the Missile Gap?"

All Clear Signal

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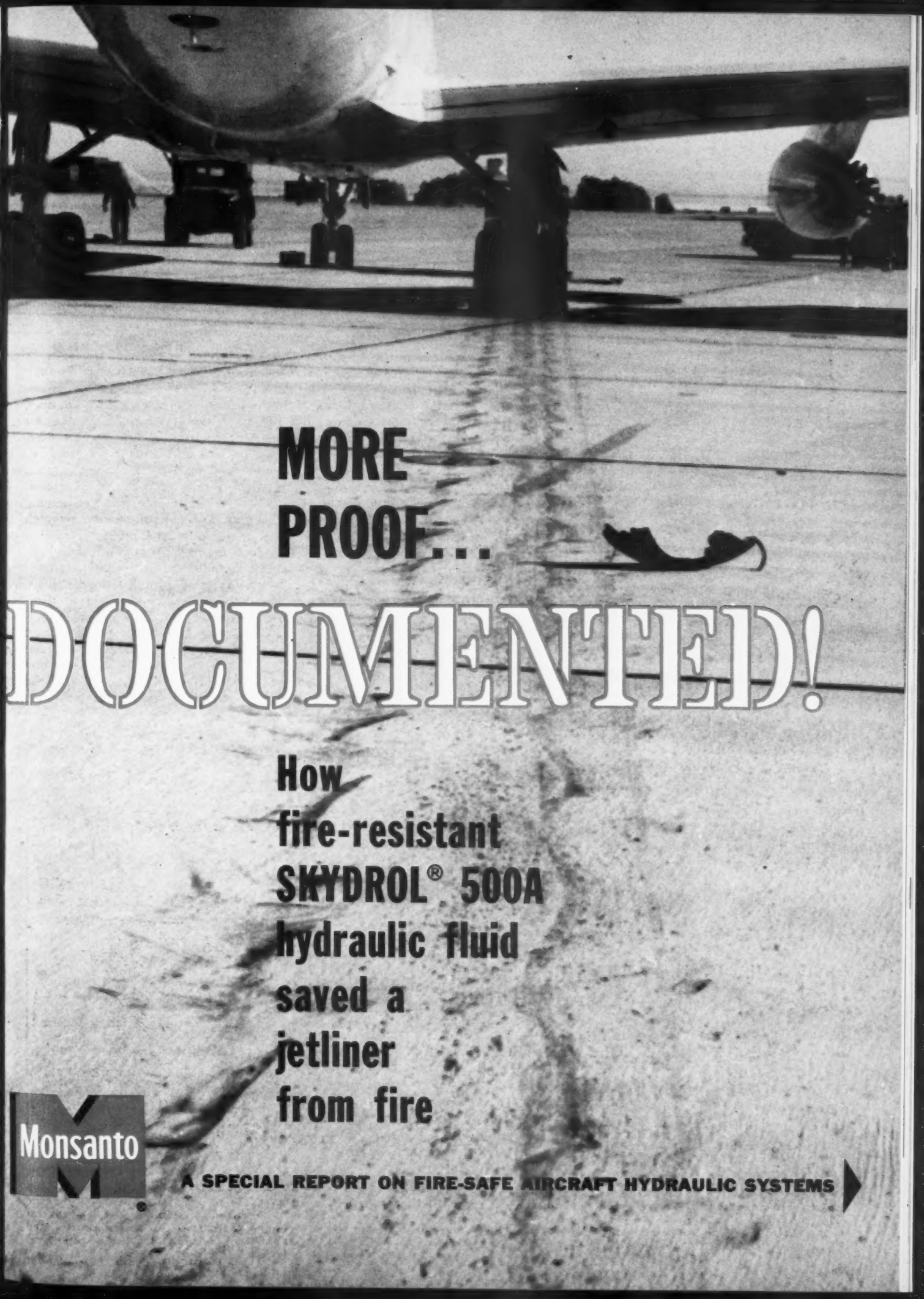
**Cartoonists, following the headlines, help popularize and perpetuate an unqualified statement attributed to the top Defense Department executive. Like the news stories on which they were based, they failed to point out that (1) the nation's strategic power was currently under study, (2) that there are so few missiles in operational readiness that it is impossible to measure our strength in early 1961 by any count of the weapons, and (3) that we must assume that Red Russia will build ICBMs in quantity. All of these observations were made by Mr. McNamara in his talk with reporters.**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A SPECIAL REPORT ON FIRE-SAFE AIRCRAFT HYDRAULIC SYSTEMS

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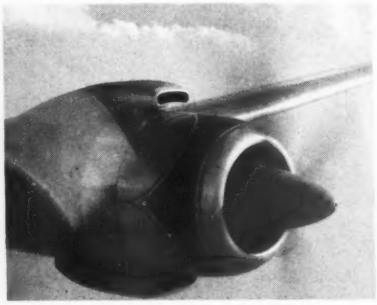

Piston-engined aircraft

- Aero Alticruiser
- Douglas DC-3
- Douglas DC-6
- Douglas DC-6A
- Douglas DC-6B
- Douglas DC-7
- Douglas DC-7C
- Convair 340

Turboprop aircraft

- Grumman Gulfstream
- Convair 540
- Vickers Vanguard
- Avro 748

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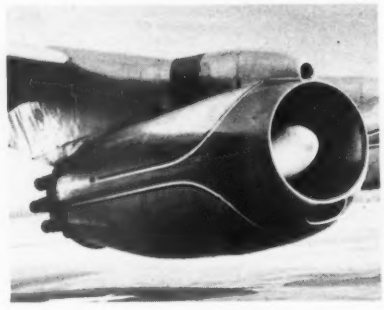

Turbojet aircraft

- Boeing 707
- Boeing 720
- Boeing 727
- Douglas DC-8
- Convair 880
- Convair 990
- Vickers VC-10
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- DeHavilland 121

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his impression of the Soviet missile program, a subject on which he had refused comment at a public press conference four days earlier. This time, the Secretary burdened his reply with qualifications. He said he had no information on what the Russians are expected to do in the years just ahead. He said he had no evidence of a "crash" ICBM program in Russia. He cautioned that any impression he might have today could change tomorrow. He said Russia, he knows, is putting a high percentage of its national effort into defense and that their rocket capabilities obviously are good. On an average, it is his impression that their technology is roughly equal to ours. He feels that in the interest of national security we must assume that Russia will build ICBMs "in quantity." Despite this, he does not feel there will be a "destruction gap" in the next few years because of America's strength in other weapon systems. He pointed out, in this connection, that it is not useful to talk about intercontinental missiles alone without some evaluation of the other weapon systems and what they contribute to our stature. For this reason, the Secretary said he does not favor use of the term "missile gap" in the "narrow sense." After all, as of today, no major power has a large number of ICBMs. And he does not believe, as of today, there is a missile gap.

You know what happened. The next morning's New York *Times* headlined: "Kennedy Defense Study Finds No Evidence of a Missile Gap." And, said the Washington *Post:* "No Missile Gap Exists, Defense Study Shows." Mr. Sylvester, who had assumed that a background conference would produce no headlines, found he had overestimated his audience and erred seriously when he did not clearly state that there was an embargo on the information. The reporters who went straight to their typewriters, without exception, ignored the long list of qualifications surrounding the McNamara statement. In addition, by their haste as well as their distortion, they have cut short their three-week honeymoon with the McNamara administration. It is highly problematical that he will meet the press again on this basis.

One of the Pentagon's most senior newsmen later gave it as his opinion that a few of his colleagues had pulled remarks out of a bull session, turned them into possibilities, then turned the possibilities into probabilities and—for the sake of a headline—finished the transformation of probabilities into realities. They made news for another forty-eight hours, at least, and turned the heads of a long list of editorial writers, cartoonists, and congressmen, mainly Republicans. The reaction was so severe that the White House was forced to issue a statement labeling the news stories as inaccurate. The President had to point out that the Pentagon strategic study is not finished and that it was impossible, at the moment, to say "whether there is a missile gap or not." He added that Mr. McNamara probably will agree that background press briefings are "hazardous."

Somehow, the issue at this writing no longer seems to be the existence or nonexistence of a missile gap, except as that issue is perpetuated by the press, feeding now on the politicians. Mr. McNamara has said, and he is supported by his boss, that the question will be put in its proper slot in an over-all evaluation of our strategic position. The majority of the reporters who attended the McNamara conference—and this correspondent was not among the invited—did not violate the confidence they had received. Many of them are outspoken in criticism of their fellows who quoted the Secretary out of context and started this row. The controversy will not help the new President in his determination to "reexamine and revise our whole arsenal of tools—military, economic, and political." If the American free press is to help win this war—and nobody has denied there is a conflict—maybe it should reflect on the fourth estate as part of that arsenal. The job carries responsibilities.

## Can Do

Robert Lovett, a Republican and former Secretary of Defense in a Democratic Administration, told a Senate committee last year that "the idea seems to have got around that just because some decision may affect your activities, you automatically have a right to take part in making it."

There are signs now that the Kennedy Administration is exercising executive power and that more people will have to do as they are told instead of deciding why they can't do anything. One of the most encouraging steps is the abolition of the Operations Coordinating Board. This was a committee charged with preparing plans for carrying out National Security Council policies and reporting on progress made in carrying them out. Former Secretary of State Christian Herter, who was chairman of OCB for two years, said that at times he felt he was "fanning the air or spending a lot of time reviewing minutiae." In any event, the Subcommittee on National Policy Machinery of the Senate Committee on Government Operations concluded that OCB "has little impact on the real coordination of policy execution. Yet, at the same time, the existence of this elaborate machinery creates a false sense of security by inviting the conclusion that the problem of teamwork in the execution of policy is well in hand."

There are other matters being taken care of in the capitol these days by executive decree. Robert S. McNamara, the Secretary of Defense, has cut the number of assistant secretaries in the Pentagon from fifteen to thirteen. Thirteen still is "far too many," but it is a step in the right direction, he said. He has combined the post of Assistant Secretary for Properties and Installations with that of Supply and Logistics. He has dropped the job of Assistant Secretary, Health and Medical, moving the functions over to the Assistant Secretary, Manpower. Further, he has set up an office of management planning and organizational studies. Evidently to stay away from the thirteen assistant secretaries, each of whom could have a vested interest in new recommendations, the study has been assigned to the office of Cyrus Vance, the Defense Department's General Counsel.

Actions such as these appear to be taking some of the city by surprise. They shouldn't, because the Senate Subcommittee on National Policy Machinery, which is headed by Henry M. Jackson, Democratic Chairman in the 1960 campaign, has been pointing the way. One report, issued during the election fracas, said there was a need for the President to delegate more authority, for him to get more useful aid out of the National Security Council and the Secretary of State. It also said—and these recommendations are of prime importance if we are to understand what is coming in the Pentagon—that military power must be related more closely to foreign policy, and that the budgetary process must be restored as a program-managing tool of the President.

Said the committee: "Only the President's responsibility is as wide as the nation's affairs. Only he can balance domestic, economic, and defense needs—and if anyone else were to be given the job the President would become a kind of constitutional figurehead."—END

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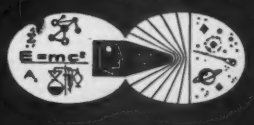
*Shown is heat exchanger section of a nuclear- or solar-powered Stirling-cycle engine under development for space and terrestrial power systems.*

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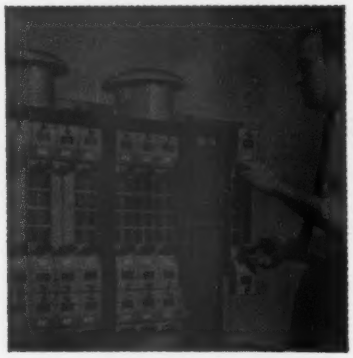

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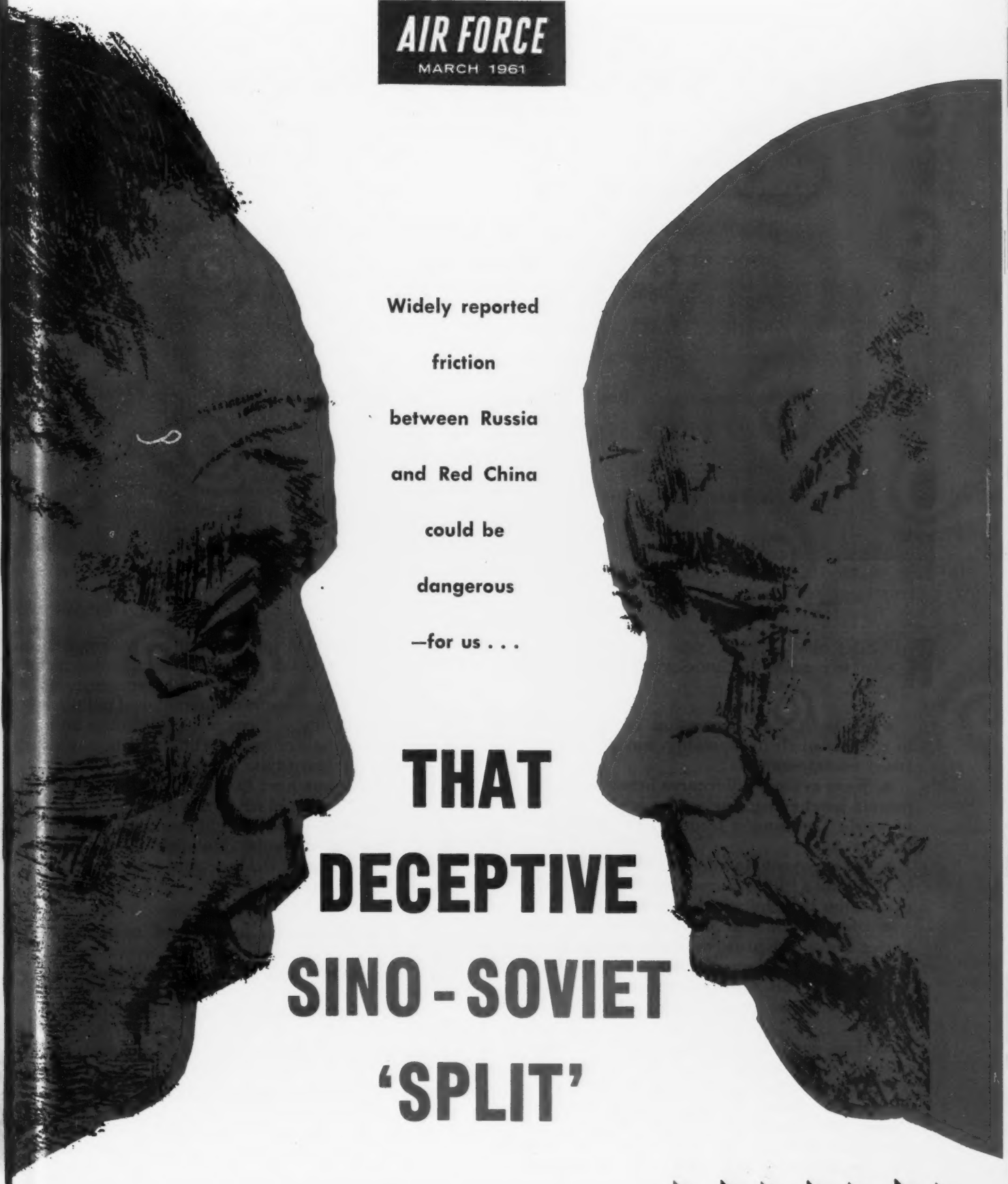


Widely reported friction between Russia and Red China could be dangerous —for us . . .

# THAT DECEPTIVE SINO-SOVIET 'SPLIT'

*A SPECIAL REPORT*

# RED IS RED — *Whether Chinese or Russian*

**Recent speculation about the possibility of a split between the Red Chinese and Moscow is wishful thinking. Here are four major points to bear in mind in assessing what you read and hear:**

1. **The Communists, Chinese or Russian or whatever, deliberately manipulate words to conceal intent and strategy.**
2. **Moscow and Peiping have agreed on tactics to confuse the free world. "Local" crises will occur more often. "Coexistence" maneuvers will be intensified.**
3. **We must plan now for the day, not far off, when the Red Chinese will have nuclear weapons.**
4. **The Sino-Soviet threat will continue. It makes little difference who is boss or whether they are equal partners.**

RECENT developments pose an urgent requirement to reassess the Sino-Soviet threat to the free world.

- **Is Red China attempting independently to attain a nuclear capability, having been refused Soviet weapons?**
- **Were evident differences between the two powers patched up during the secret meeting of world Communist leaders held at Moscow late last year?**
- **Do apparent Red desires to turn the war in Laos into a "little Korea" represent a Soviet concession to Peiping's demands?**
- **Did the Chinese Communists approve Soviet Premier Khrushchev's inaugural greeting to President Kennedy expressing the hope that, under his Administration, US-Soviet Union relations once more could be improved?**
- **How does Khrushchev intend to reconcile his most recent cries for "coexistence" with his continuing support for the late Lumumba's forces in the Congo and Cuba's Castro, his efforts to weaken the UN, and his continued attempts to intimidate our allies into withdrawing our overseas base rights?**

These are but a few of the questions posed by recent events. Underlying them all is a primary question which the new Administration must seek to answer: What are the main factors of the Sino-Soviet as it exists today, and how is this threat likely to evolve in the future? The interplay of moves and countermoves yet to come in the chess game of international politics nullifies the possibility of a completely definitive answer. But a brief analysis of four essential points may serve to sharpen our perspective considerably.

Wishful thinkers tend to seize upon each report of a purported Sino-Soviet rift as new evidence that eventually the two powers will fight one another and permit us to relax and enjoy life again. Unfortunately, such optimism ignores the important fact which constitutes point number one:

**1** A basic reason for current misunderstandings about the functioning of the Sino-Soviet alliance is the Communists' deliberate manipulation of words to conceal actual intentions and strategy.

A voluminous exchange of polemics was published throughout most of 1960 in leading Chinese Communist and Soviet journals. On the surface, it appeared to reflect contradictory positions, but, before jumping

to conclusions, it is important to recall that deceit long has been a prime requirement of Communist conflict doctrine. In addition, years of experience have led to new refinements of old techniques.

Dr. Stefan T. Possony, faculty member at Georgetown University's Graduate School and an authority on Communist techniques of semantic warfare, has formulated what serves as a succinct resumé of how the Chinese and Soviets now are using word manipulation in an attempt to deceive us. In an article published in the July 9, 1960, issue of *The Saturday Evening Post*, Dr. Possony observed:

"As Communist semanticists attained virtuoso skills, they discovered that, in many instances, communications [could] be made to serve a dual purpose—to say one thing to Communists while simultaneously conveying quite a different message to non-Communists."

The most recent Sino-Soviet polemical exchange, which began in April 1960 and continued into December, is a dramatic example of current Communist skillfulness in the use of double-meaning language to serve the dual purpose of communicating with the comrades while simultaneously confusing the enemy. A careful examination of the record reveals that the so-called debate centered around four key areas:

- Which tactical tricks from the Communists' bulging bag were best suited to contemporary conflict requirements?
- How should current maneuvers be timed to maximize their effectiveness?
- What limits did US nuclear firepower pose on Communist freedom of action to encourage the numerous "revolutionary opportunities" which were continuing to arise in underdeveloped areas?
- How could "contradictions" stemming from the simultaneous existence of "revolutionary opportunities" in newly emerging states and the continuing necessity to deceive and weaken the US best be reconciled.

Skillful manipulation of words characterized the entire exchange. Moscow emphasized the necessity for disarmament and coexistence. Peiping, by contrast, repeated in outspoken terms the importance of the roles of violence and warfare in bringing Communists to power. Red Chinese spokesmen also emphasized that the United States continued to be the principal enemy and argued the necessity for Communists to actively support all "national liberation movements" in underdeveloped areas.

On the surface, the differences in viewpoint seem to be considerable. But after the verbiage had been swept aside, it was clear that Moscow and Peiping were arguing the same principles. The very same bloody messages from Peiping which spoke primarily of violence and struggle also took note of the "greater possibilities, under some circumstances, for the peaceful development of the revolution" (*Red Flag*, April 15, 1960). And Moscow, while pressing for peaceful coexistence, never failed to admit, simultaneously, that in states possessing strong military capabilities "armed class struggle"—*i.e.* war—would be required to guarantee the success of any Communist attempt to seize power. Sino-Soviet spokesmen were apparently playing their own particular version of vaudeville's end-man and interlocutor. More recent developments, discussed below, have confirmed this interpretation.

**2 Moscow and Peiping have agreed to concentrate, for the moment, on tactics designed to break down our resistance. "Local" crises are to be stirred up and caused to occur with increasing frequency. Simultaneously, "coexistence" maneuvers designed to force us to sign hasty disarmament agreements are to be intensified.**

The most recent strategy session of the leaders of the international Communist movement took place behind closed doors at the Kremlin during the weeks immediately following the annual celebration of the anniversary of the Bolshevik revolution on November 7. The Yugoslav leaders were conspicuously absent, the Chinese Communists and the Soviets very much present, and high-ranking Communists from at least seventy-nine other nations, within the bloc and without, were on hand. A lengthy multiparty declaration was widely published early in December. *Pravda* carried the text on December 6. The published declaration disclosed the broad outline of the tactics Moscow and Peiping intend to emphasize for the moment. The main points set forth in the document were:

- While the tactics of "peaceful coexistence" are to be further upgraded, coexistence is *not* a concession to non-Communists. It is an *active* form of class struggle, a "policy of mobilizing the masses in launching vigorous action against the enemies of peace. . . ." Any and all groups and individuals that can be made to fear a nuclear war and its consequences are to become part of a greatly enlarged temporary coalition of the "peace elements." This expanded "peace front" will be manipulated to wage nuclear war psychopolitically and to join the Communists in pressurizing the West into disarming.
- Concurrently, encouragement of "national liberation movements"—*i.e.* local struggle in underdeveloped areas—is to be intensified. The declaration states: "The breakdown of the system of colonial slavery under the impact of the national liberation movement is a development ranking second in historical importance only to the formation of the world socialist system."
- Moscow retains hegemony over the international Communist movement; all strategies will continue to be formulated—or approved—by the Kremlin.

Khrushchev expanded these principles in a January 6 report to key members of the Soviet intelligentsia. In

*(Continued on following page)*

essence he spelled out why renewed attempts to disarm and weaken the West were necessary. The problem of how to unleash nuclear war without absorbing unacceptable levels of destruction in the form of retaliatory blows and fallout must somehow be solved, he said. But the tactical decisions taken at the multiparty meeting must not be interpreted to mean that the pace of the Soviet military buildup was to be slackened.

On January 21, the Chinese Communist Central Committee also issued a statement endorsing the eighty-one party declaration. No Sino-Soviet disagreement over fundamental principles was apparent.

The one question which neither Moscow now Peiping has answered so far is this: How do the Communists intend now to go about trying to disarm the West unilaterally while keeping some nuclear weapons for their own later use?

Even before Khrushchev's January 6 speech, high-level Soviet military spokesmen—and Khrushchev himself—had hinted of their preoccupation with how to work out a way to wage nuclear war successfully without suffering, in the process, an unacceptable level of retaliation. History has recorded the Communists' penchant for negotiating international agreements to serve their own ends, only to break them without notice whenever such a move best serves their purposes. Our own security depends upon a suspicious scrutiny of each new "disarmament" maneuver they initiate.

Already, the Chinese leaders have stated publicly that they will not adhere to any disarmament agreement unless they have participated in the negotiating sessions. There also have been hints that soon Red China will explode a nuclear device of its own. Both of these developments, plus elaborate maneuvers to suggest to the West that a rift between Moscow and Peiping is imminent, could be part of a plan, jointly agreed upon in advance, to deceive us. If the US could be convinced, somehow, to believe that Moscow sincerely intended to adhere to a disarmament agreement, that she was unable to control the behavior of the Red Chinese, and that the Kremlin was displeased over Chinese bellicosity, fresh avenues would thereby be opened for Moscow and Peiping to attempt to retain some nuclear weapons while depriving us of our own. Such a deceptive strategy would pose less risk to the Soviets, in the long run, than cheating on a disarmament agreement, although a combination of both tactics would run true to Communist form.

Even if the United States should agree to such a minimal move as a nuclear test ban treaty, while the Communists retained the freedom to test in China, the likelihood of their eventually winning the weapons lead-time race would be enhanced. Insofar as the Soviet leaders are concerned, this is the prime objective, one to which all other goals must be subordinated.

Further, Khrushchev's current thinking could well be along these lines. If the USSR moves present-generation weapons and key military R&D and manufacturing centers to Red China, along with sufficient Soviet personnel to continue operations there, it might be possible to dupe the West into getting rid of its strategic strike capability while the Reds secretly retain theirs. If necessary, once its arsenal had been transferred to remote areas in China, the USSR could permit inspection of its own territory on US terms. Then the US would pretty well *have* to agree to nuclear disarmament.

Risks to Russia that the Chinese would attempt to seize installations for their own use could be nullified if sufficient Soviet troops guarded them. Since the Chinese will continue to depend heavily on Soviet advanced technology for a long time to come, they cannot go too far in antagonizing the Kremlin; it is unlikely that such elaborate safeguards actually would be necessary. Moreover, the two powers seem really to be working in concert against the West rather than concentrating unduly over tactical priorities.

**3 The Chinese Communists seem to be working to acquire nuclear weapons. We should plan now to meet this contingency.**

Last fall, Chou En-lai granted an interview to Edgar Snow; the text was published in the January 31, 1961, issue of *Look* Magazine. The interviewer asked: "How *soon* does China expect to be making nuclear weapons of its own?" Chou replied, laconically: "I can briefly state that I, myself, don't know when we will be making nuclear weapons."

However, other statements by the Chinese leaders have specifically claimed that the Chinese Peoples Republic (CPR) will have nuclear weapons eventually. Western observers agree. For example, a symposium on Chinese science and technology was held in conjunction with the annual convention of the American Association for the Advancement of Science in New York last December. Robert T. Byer, a physicist at Brown University, estimated that the Chinese Communists could explode their first A-bomb in five years. Sir C. P. Snow of Great Britain, speaking at the same meeting, said: "Within, at the most, six years, China and several other states will have a stock of nuclear bombs."

Both of these estimates were based on analysis of the progress the Chinese have made in implementing their "Twelve-Year Plan for Science," inaugurated late in 1955. The objective was to try to catch up with the technologically advanced nations in key fields. At first, the Chinese attempted to inaugurate their plan with a minimum of Soviet help. But setbacks occurred. After talks at Moscow, an agreement was signed on January 18, 1958, which made the plan a joint Sino-Soviet venture. Neither the Chinese nor the Soviets have disclosed what priority, if any, was assigned to military applications of nuclear energy. Nor has Soviet delivery of any nuclear weapons to China been announced. But the Chinese have declared their intent to develop a modern defense industry and to transform China into a strong socialist state as a result of having under-

taken the plan. It is safe to assume that they are hard at work to develop a nuclear device, either with or without Soviet assistance. Possessing even a token nuclear capability would greatly enhance the CPR's status in the alliance and in the world at large.

When the Chinese Communists announce to the world that they have successfully tested a nuclear device, we must be prepared to deal with the situation. In the ensuing excitement, the United States must take precautions not to lose sight of several important points.

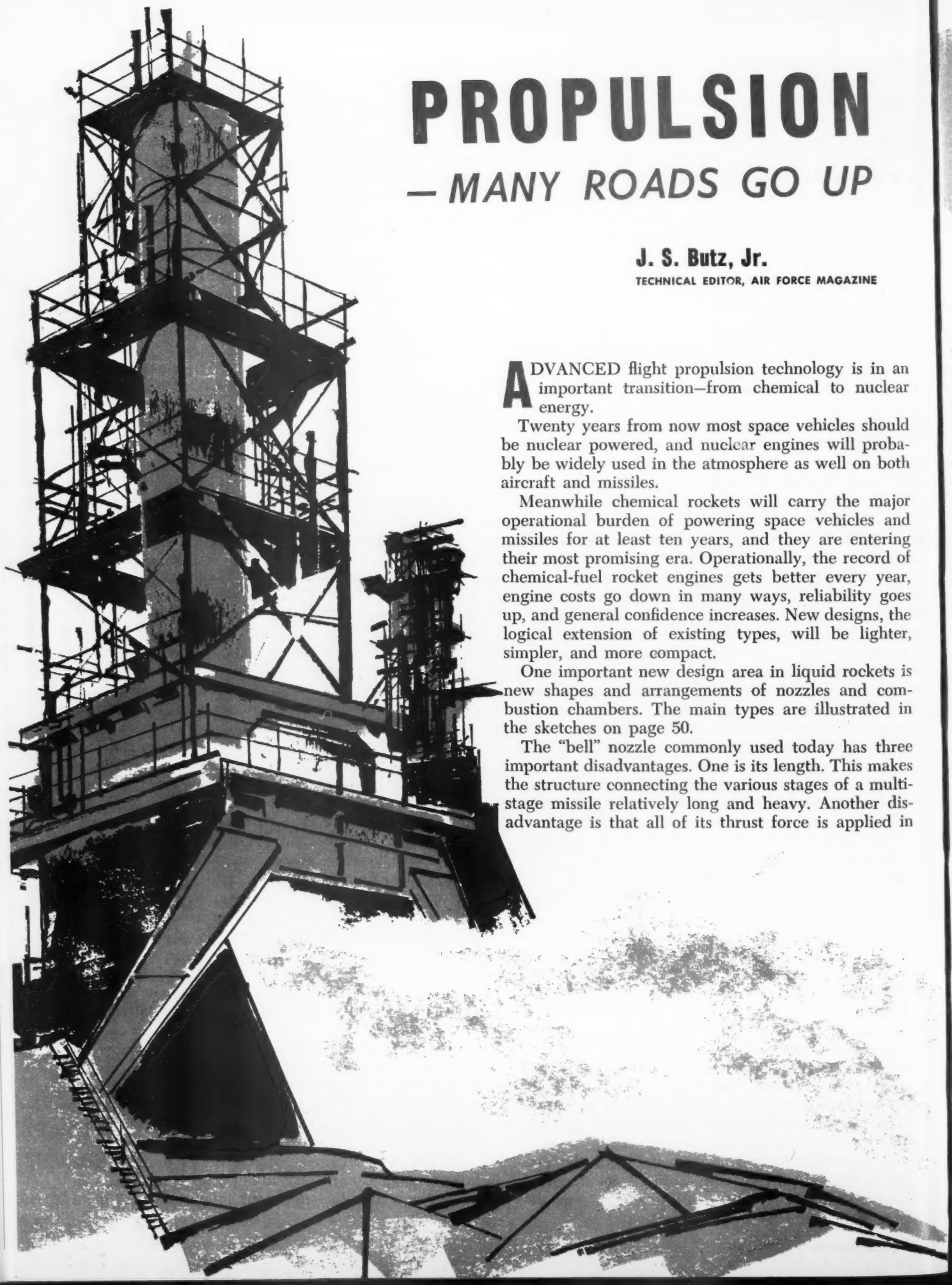
- The event will have great impact on the leaders of the technologically backward nations in Asia and Africa. Irrespective of the true facts, the Communists are likely to play up the test as something the Chinese have accomplished without help from Moscow. African and Asian leaders are already impressed with the phenomenal strides China has made to industrialize an agrarian economy against formidable odds. They visualize China's accomplishments, unlike Moscow's, as symbolic of something they, too, can realistically hope to achieve. Should China explode a nuclear device, these leaders will be appropriately awed.
- China will seek to exploit the situation and use its token nuclear capability as a lever for extending its sphere of influence and realizing its objectives in Asia. Attempts to foment revolutions in all the underdeveloped countries of the areas will be intensified, threats may be followed by full-scale invasion attempts by China's conventional forces, and efforts to force Japan to align herself with the Communist bloc may eventuate.
- How far China will go in such maneuvers and how quickly she will move will depend, primarily, on whether or not, in the meantime, Moscow has succeeded in controlling the conduct of the integrated foreign policy of international communism. If the Soviet leaders estimate that their own attempts to attain at lease some degree of unilateral Western disarmament have, meanwhile, increased their relative military strength to a point where it is time to take on the United States directly, bellicose Red moves in Asia could serve as the curtain raiser for central war. But if the US has not backed down in the meantime, the risks Moscow would incur by initiating global war still would outweigh the gains.
- Even when she possesses a token nuclear capability, China, unless joined by the USSR, will not be capable of waging war against the major Western powers. Even if she works at breakneck speed, it will take her some years to advance from a neophyte member of the nuclear club possessing a Hiroshima-type bomb to one controlling the equivalent of today's weapon systems. Military technology continues to advance rapidly. By the time China has brought her military establishment in line with today's standards, tomorrow's weapons will have been phased into the US and Soviet arsenals.
- In the final analysis, the capability of the free world to deal effectively with China's attainment of a token nuclear capability will depend upon the United States's refusal, in the meantime, to succumb to the tactics of constant nuclear terrorization that the Communists now are applying against us. In fact, the Kremlin can hand the Red Chinese an obsolete nuclear weapon and help the Chinese to explode it any day the Soviets choose. We should show our courage by calling the Communists' bluff in the right way at the right moment. Meanwhile, we should refuse even to continue to adhere to a gentleman's agreement on a nuclear test ban, a development which is seriously jeopardizing our own R&D efforts. Once we are alerted to all Communist machinations designed to weaken us militarily, psychologically, and politically, we, like they, will lose our fears of nuclear firepower and evaluate Communist psychopolitical use of this weapon as realistically as we must also evaluate the possibilities of their using it actually.

**4** **The Sino-Soviet threat will continue indefinitely, irrespective of whether Moscow retains control or whether Peiping achieves her goal to become an equal partner.**

It is impossible to say with certainty whether or not the Red Chinese ever will become a nation sufficiently industrialized to challenge the Kremlin's hegemony over the international Communist movement. So far, China has shown no signs of such potential. Despite understandable differences, the two powers continue to work in concert to try to defeat the principal enemy they commonly share: the United States. Even serious agricultural setbacks in both nations have not forced any relaxation of this ruthless dedication to the main objective—wearing down our resistance and resolution by any and all available means while simultaneously continuing their own military buildup. Eventually, the alliance may evolve into an equal partnership, complicating our already difficult task of meeting the challenges and threats it poses. But relaxing our vigilance and rationalizing our behavior with idle and unrealistic dreams of the day when the Red Chinese will initiate war against the Soviets—or vice versa—would be our greatest national mistake, one which there would be no opportunity to rectify.

The Communists have announced their intentions to conduct a ruthless program of diverting our attention from one local crisis to another along the pattern evident in Laos and the Congo. Simultaneously, they have served warning that they will build up pressures for nuclear disarmament by intensifying already existent Western fears of nuclear war. Since they have revealed their strategy, we have no justification for cooperating with their attempts to realize their announced objectives.

In the long run, ensuring a priori the complete failure of all Communist attempts to disarm us will be the only effective deterrent to our own ultimate capitulation.—END



# PROPULSION
## —MANY ROADS GO UP

**J. S. Butz, Jr.**
TECHNICAL EDITOR, AIR FORCE MAGAZINE

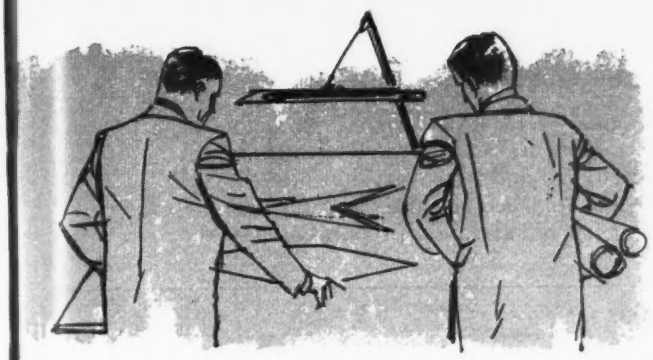
ADVANCED flight propulsion technology is in an important transition—from chemical to nuclear energy.

Twenty years from now most space vehicles should be nuclear powered, and nuclear engines will probably be widely used in the atmosphere as well on both aircraft and missiles.

Meanwhile chemical rockets will carry the major operational burden of powering space vehicles and missiles for at least ten years, and they are entering their most promising era. Operationally, the record of chemical-fuel rocket engines gets better every year, engine costs go down in many ways, reliability goes up, and general confidence increases. New designs, the logical extension of existing types, will be lighter, simpler, and more compact.

One important new design area in liquid rockets is new shapes and arrangements of nozzles and combustion chambers. The main types are illustrated in the sketches on page 50.

The "bell" nozzle commonly used today has three important disadvantages. One is its length. This makes the structure connecting the various stages of a multistage missile relatively long and heavy. Another disadvantage is that all of its thrust force is applied in



**Chemical propellants, solid and liquid, are today entering their most promising developmental stage. Twenty years from now, by contrast, nuclear energy will probably have come into its own in space vehicles, aircraft, and missiles. The transition from one form of propulsion to another must be a central factor in our thinking in the years just ahead . . .**

## PART II — SPACE ENGINES

one small area, through the top of its combustion chamber. As a result, the thrust structure which spreads this point load around the base of the missile must be relatively heavy. Both these weight factors must be paid for with a reduced vehicle payload. The third disadvantage of the bell nozzle is that it cannot operate efficiently at both sea level and altitude. Maximum nozzle efficiency requires a different ratio of nozzle throat area to nozzle exit area at each altitude. Since these areas are fixed on the bell nozzle it can attain its best efficiency at only one altitude.

Some of the disadvantages of the bell nozzle are overcome with the plug and expansion-deflection nozzles. Both are shorter than the bell and can have lighter interstage structure. Also both have relatively good performance at all altitudes because, even though their throat areas are fixed, their exit area adjusts naturally to allow proper flow expansion under all altitude conditions. This is best illustrated with the plug nozzle where the effective exit area is the cross-sectional area of the flow as it passes the tip of the plug. Since there is no outer wall to hold the exhaust flow in, it expands without restraint until its pressure is equal to the pressure of the atmosphere. At sea level the high atmospheric pressure keeps the area of the exit flow small. But at altitude, under low-atmospheric-pressure conditions, the rocket exhaust expands until its diameter is several times that of the missile the engine is propelling. This freedom of exhaust expansion allows good flow conditions to exist at all altitudes.

The expansion-deflection nozzle is basically the plug nozzle turned inside out, and the exit area flow adjustment takes place inward rather than outward.

Structurally, the wide ring-shaped combustion chamber of the plug nozzle has the advantage of spreading the thrust load over a large area so that it can be transmitted into the tanks with a relatively light structure. Its disadvantage is that its combustion chamber weight is unusually high because it is so spread out. The E-D nozzle's structural attributes are about the same as the bell nozzle. It has a light combustion chamber but transmits a concentrated load.

One logical combination and extension of the plug and E-D nozzle concepts, which would retain their good altitude characteristics and would have a relatively light and compact combustion chamber, is the "reverse-flow" nozzle. An engine using this nozzle would be very short and its interstage structure would be almost the conceivable minimum. Its thrust load would also be spread out and applied to a vehicle through the mushroom-shaped nozzle shell as it bends upward around the combustion chamber (*see page 50*).

These are only a sample of the new nozzle and engine geometrics being studied to improve the performance of liquid-fuel rockets, and this is only one of many design areas in which advances are being made. New materials, higher operating pressures, and new propellants such as liquid hydrogen all are contributing to higher-performance engines. Significant progress has been made in the development of storable, liquid-propellant engines, hermetically sealed, instantly ready for use after long periods of coasting in space or storage on the ground.

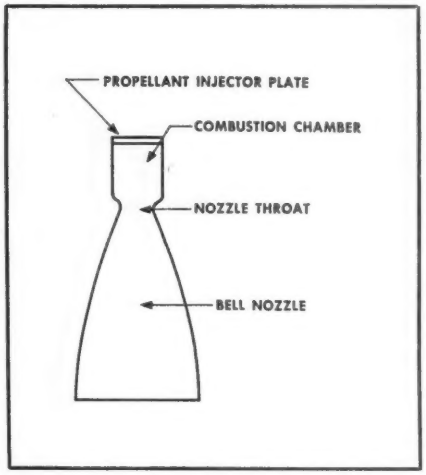
Liquid rockets, which up to now have been a maze of valves, pumps, sensors, and pipes, are being greatly simplified. Each engine in the Saturn cluster, for instance, has only three moving parts and is started by a solid-propellant charge. The ultimate simplification is to have only one moving part—the shaft, turbine wheel, and impeller combination in the turbopump. This appears to be possible, but there are doubts about thrust control accuracy on such an engine, which determines ability to power a vehicle along a precision course.

The number and variety of new developments with solid-propellant rockets are even greater than in liquid-engine design. The high reliability already demonstrated by solid rockets is cited as a major reason why they make good boosters for large space payloads. In general, the takeoff gross weight of any space vehicle would be considerably larger if it were powered by solid-fuel rockets rather than liquid-fuel rockets. Even so, the total cost of booster operations might well be lower if the solid engines were employed.

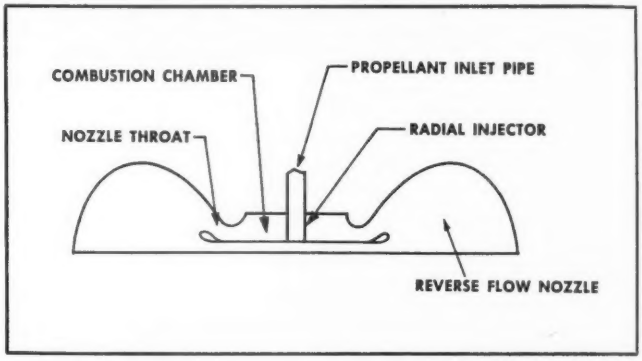
Very large total weights have been proposed for some solid-fuel booster systems, such as fourteen million pounds and more to put a 250,000-pound payload in orbit. To do the same job with the same payload the estimated weight of the Nova booster, using liquid engines, is well below ten million pounds.

(*Continued on page 51*)

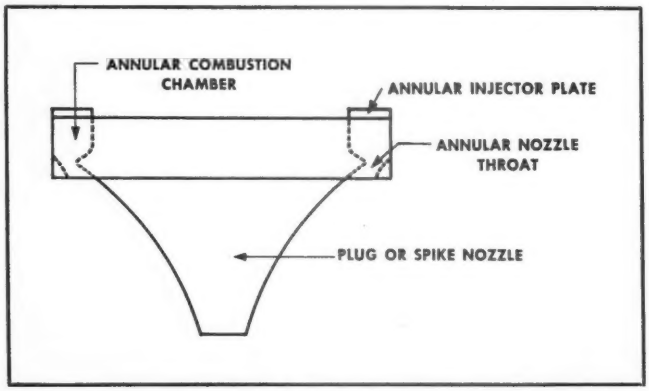
The performance potential of chemical rocket engines is far from exhausted. Major improvements in both liquid- and solid-propellant rockets are now in the development stage. A few of the new engine configurations being studied and tested are shown in the schematic drawings below. Some of the new engines should boost vehicle performance. The shift to such high-energy fuels as liquid hydrogen should also increase performance.



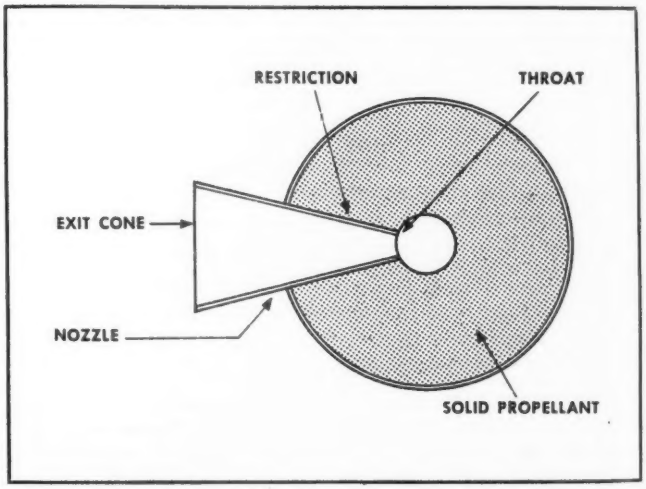

**Bell-nozzle liquid-propellant rocket engine commonly used today is shown at left. This configuration has three main disadvantages: Its performance is optimum at only one altitude, its thrust load is transferred to the missile at a single point, and its length increases the weight of the interstage structure on a missile.**



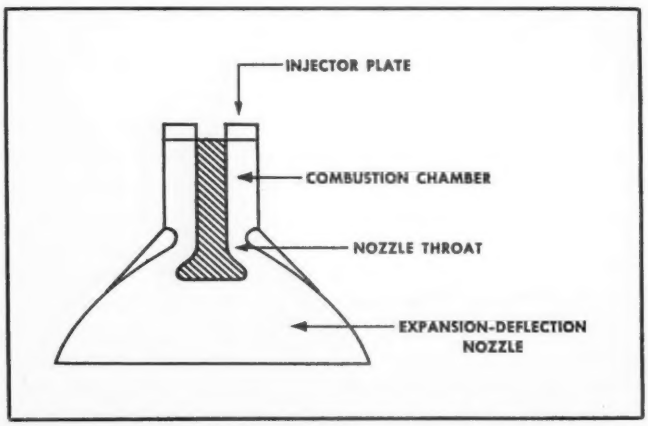

**Logical development of the expansion-deflection nozzle engine is the one above with a reverse-flow nozzle. This engine has a light combustion chamber, and no bell-nozzle disadvantages. Small performance penalty is paid because exhaust flow turns through a large angle.**



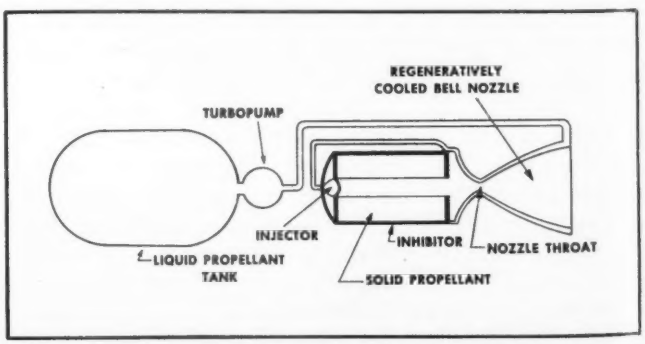

**Plug-nozzle engine (above) overcomes all the disadvantages of bell-nozzle. Thrust load is spread out, performance is good at all altitudes, and plug-nozzle engines are short. However, they are relatively heavy because their combustion chambers are of annular rather than of cylindrical shape.**



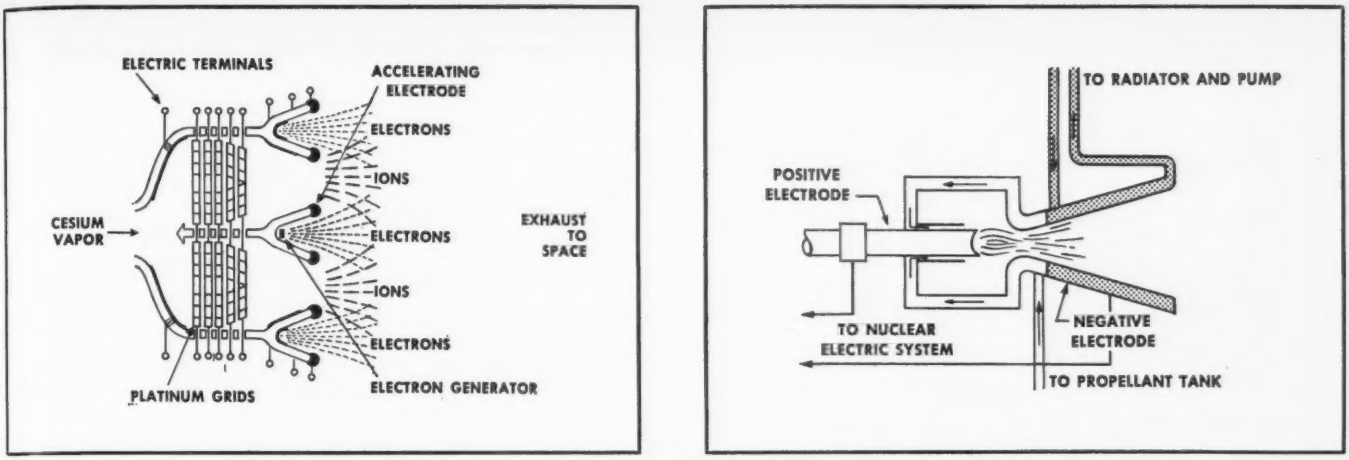

**Several new solid rocket designs are being tested. One of the most promising from weight viewpoint is the spherical rocket, above. The sphere is the lightest container that can be made from a given weight of material. Large spherical engines are proposed for space use.**




**Engines with expansion-deflection nozzles (above) have relatively light combustion chambers. They also have all of the advantages of the plug-nozzle engine except that their thrust load is applied in a way which increases the structural weight of the missile they power.**




**The tripropellant, hybrid rocket (above) using both liquid and solid propellants is in the early research stages. It has the potential of boosting the specific impulse of rockets about 50%, greatly increasing payload capacity.**




**Ion (left) and plasma (right) rockets are under intensive study in the US by several agencies. These small engines produce thrusts of a few pounds or less, but they have the advantage of a very low fuel consumption. This makes them attractive for long missions in space such as interplanetary trips, and attitude control and maneuvering rockets for long-life satellites near the earth. The primary disadvantage of these rockets is that they require large amounts of electric power. Nuclear electric-generating equipment is needed for them.**

Under most schemes solid-fuel rockets delivering from 400,000 to one million pounds thrust would be clustered to form the large boosters, and three or four stages would be required to form an adequate vehicle. Each of the engines in the clusters would be more than six feet in diameter and probably fifty feet or so in length. To reduce the difficulty and cost of producing and transporting such large engines on a quantity basis many studies and experiments have been conducted which show that it is possible to build them in short segments, six feet or more in length. The segments would be stacked together at the launching site to form a complete engine.

The solid rockets used in very large boosters of this type would probably be of relatively conservative design. Beyond these, smaller, higher-performance engines are also under development. They result primarily from improvements in two areas—higher-energy propellants and lighter combustion cases, nozzles, thrust termination devices, and other items which make up the empty weight of the engine. The spherical engine geometry shown on page 50 will provide the lightest engine for any given structural material, and engines of this shape are being tested. Many different kinds of materials are being investigated in an effort to lower the weight of solid rocket cases, including steel wire, plastics, die steel, glass filament, and many others.

Major performance improvements are also predicted by engineers working with hybrid rockets, using both liquid and solid propellants. The so-called tripropellant hybrids are credited by some researchers with about seventy-five percent of the performance potential of the Rover nuclear rocket, while high-energy liquid-fuel rockets using liquid hydrogen and liquid oxygen have about fifty percent of the Rover's potential. The tripropellant hybrid engine operation in its simplest form consists of adding hydrogen or some light gas to the exhaust flow of a solid-fuel rocket to lower its molecular weight (*see page 50*). The lowering of the molecular weight of the particles in the exhaust flow is a powerful tool for increasing the specific impulse of the propellant. When the specific impulse increases, the total thrust produced by a given weight propellant will increase and the performance of any given vehicle will improve. It can carry more weight or its final speed can be raised.

The Air Force, along with other agencies, is looking seriously into plasma and electrostatic or ion rockets (*see above*).

In the plasma rocket a propellant is heated to very high temperatures using an electric arc or shock wave. At the high temperatures the propellant molecules are broken apart into individual atoms. The heat is so intense that the atoms shed an electron and the propellant flow becomes a plasma of light negatively charged electrons and relatively heavy positively charged ions which are equal to the propellant atoms minus an electron. This plasma will conduct an electric current, and in the plasma rockets it is accelerated by a magnetic field to very high velocities.

In the ion rocket, only the positive particles, the ions, are accelerated inside of the engine. Just outside of the "nozzle," however, the high-velocity stream of ions is sprayed with electrons so that an electrically neutral flow is created.

Both the plasma and ion engines produce a few pounds of thrust at the most, and therefore they will only be useful in space, where the vehicles they power are self-supported in a weightless condition. These engines are attractive because the exhaust velocity of their propellant is much higher than that possible with chemical reactions, which in turn gives them a very high specific impulse (low fuel consumption).

Major problems with electric rockets are the large amounts of power needed and the weight of their electrical-generating equipment, much larger than that of the thrust-producing unit. Two heat sources are being considered to drive this generating equipment—a nuclear reactor and a solar mirror which focuses the sun's heat on a boiler.

The first test flight for an electric engine is scheduled for 1963 by NASA when an ion rocket will be sent into an hourlong zero-gravity trajectory by a Scout rocket and powered during this time by batteries. In 1964 this same type of engine is due to be

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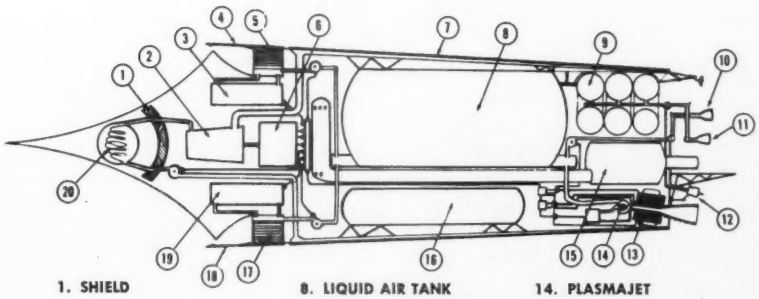


1. SHIELD
2. TURBINE
3. CRYOSTAT
4. RADIATOR FOR CRYOSTAT
5. REFRIGERATOR
6. GENERATOR
7. RADIATOR FOR CLOSED-CYCLE NUCLEAR BOILER
8. LIQUID AIR TANK
9. LIQUID HYDROGEN TANKS
10. LIQUID AIR TAP
11. LIQUID HYDROGEN TAP
12. AUXILIARY CHEMICAL ROCKET ENGINE
13. MAGNETOGASDYNAMIC DRIVER
14. PLASMAJET
15. CREW
16. LIQUID OXYGEN TANK
17. REFRIGERATOR
18. RADIATOR FOR CRYOSTAT
19. CRYOSTAT
20. NUCLEAR REACTOR AND BOILER

**Air liquefaction and storage vehicle suggested by Northrop scientists to operate fifty to sixty miles above the earth as a refueling station is shown at right. It would have to be propelled continuously in orbit to overcome its high drag. The propulsion would be provided by a type of electric engine, a magnetogasdynamic driver (number 13). The air density at fifty miles is so low that it would take many weeks for this vehicle, which is longer than 100 feet, to fill its propellant tanks. The value of this machine is that it could reduce the propellant requirements for many space missions by more than fifty percent.**

placed into orbit and operated by a thirty-kilowatt nuclear reactor. The ion rocket to be used in these tests will produce about one-half pound of thrust. Such engines will be useful for satellite control, slow maneuvering, and change of orbit and for basic vehicle propulsion on long and slow interplanetary trips.

Operating costs can be cut and the performance of space vehicles can be increased if an oxidizer supply can be drawn from the atmosphere.

Several systems for liquefying and storing air during flight in the atmosphere have been proposed, and current technical opinion is widely divided over the size, weight, performance, and even the feasibility of these systems. There are two basic types. One operates at relatively low altitudes, 50,000 to 120,000 feet, and low speeds, from about Mach 3 to 10. The other system would collect air at altitudes of from fifty to sixty miles at orbital speeds of about 18,000 miles per hour.

One objective with the low-altitude system is to allow an aerospace plane (a single-stage aircraft which can fly into orbit) to take aboard a large supply of liquid oxygen as it accelerates through the supersonic speed range. During this acceleration and air-collection period the vehicle would be powered by ramjets, which theoretically will give their best performance at these speeds. Somewhere near Mach 8 the ramjets would be shut down and the oxygen supply burned in a rocket with liquid-hydrogen fuel to send the vehicle into orbit.

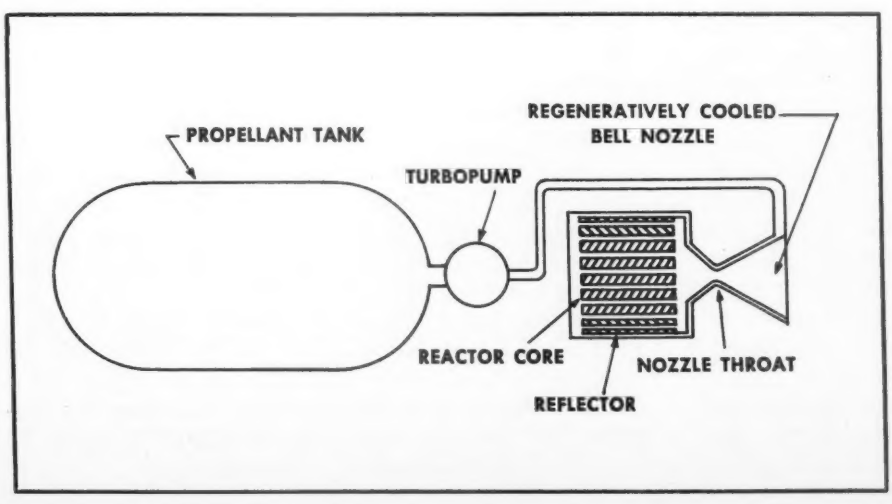
The air-liquefaction system pushes the metallurgical state of the art considerably because the air entering the system must be stopped completely, which raises the temperature several thousand degrees. This very hot, stagnated air is liquefied by passing it slowly through a large radiator, which is kept cool by running a refrigerant inside its tubes. The great temperature difference puts great strain in the radiator construction material.

Liquid hydrogen can be used as a one-pass refrigerant to operate the liquefaction system. In more advanced units a nuclear reactor could be used to drive a conventional refrigeration unit with recycling refrigerant and compressors.

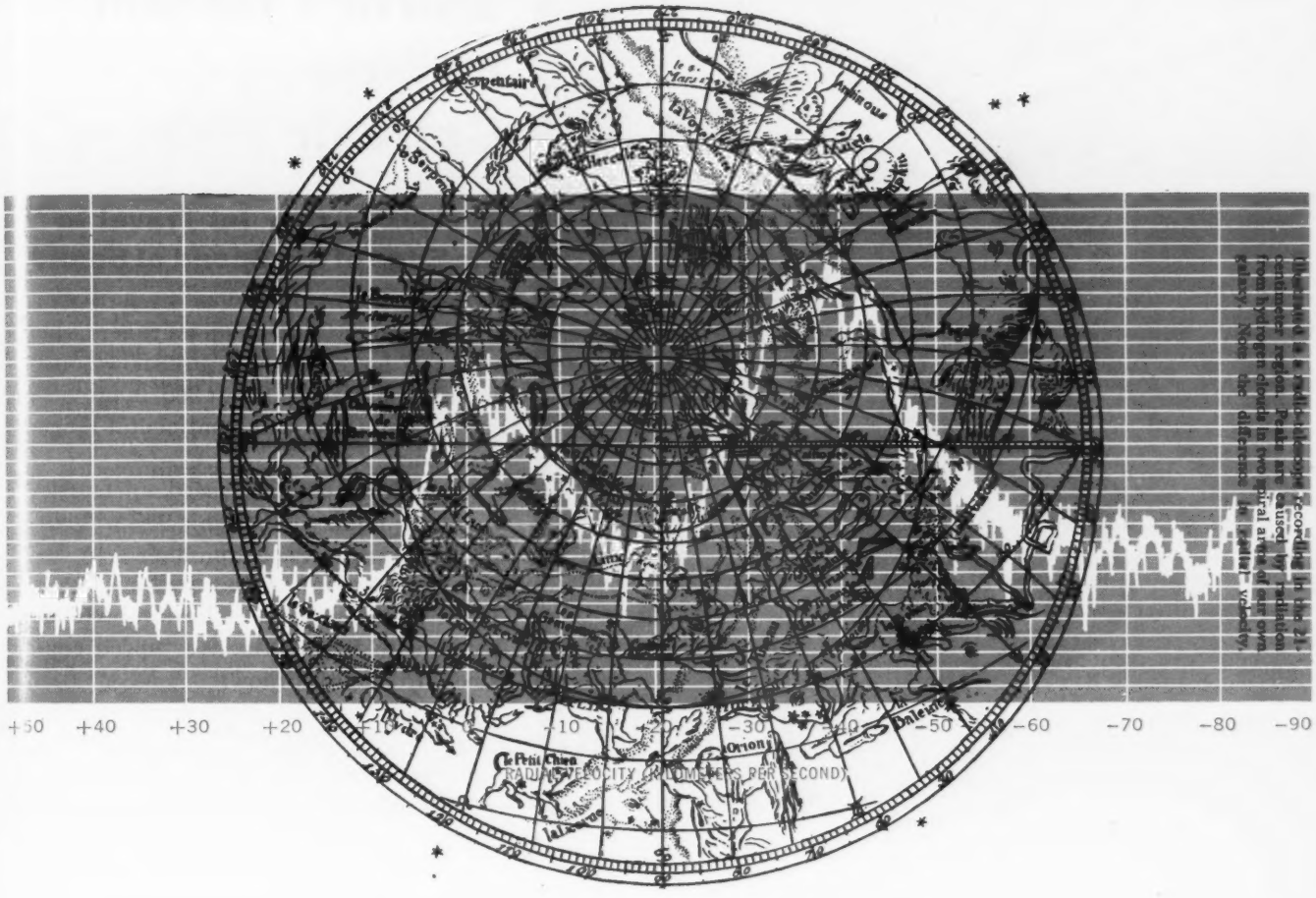
There are a number of possible designs for engines of this type and a number of ways in which they may be put to practical use in an orbital aircraft.

The high-altitude air-collection system operates on

*(Continued on page 55)*




**Simplified schematic of the type of nuclear rocket being developed in the Rover nuclear rocket program is shown at the left. The reactor core is essentially a block of solid fissionable material with many cylindrical passages running through it. The hydrogen propellant is pumped through these passages under high pressure and soaks up the nuclear heat. It is then exhausted at high velocity out of the nozzle. Nuclear rockets are more than twice as efficient as the chemical engines now in use.**

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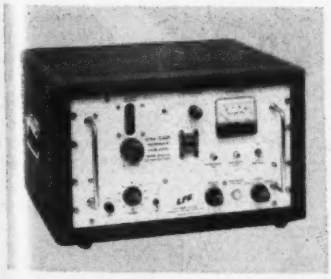

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# World's fastest airliner... Convair 990

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The second of Convair's jet airliners, the new and larger Convair 990, now joins its sister ship, the Convair 880, in providing medium- to transcontinental-range transport.

Capable of cruising speed up to 640 miles per hour, the Convair 990 will cut transcontinental nonstop flights by as much as 45 minutes. Its startling design features thinner, radically swept-back wings with four distinctive "speed capsules" to smooth airflow.

The 990 and the intercontinental version, the Coronado 990, are scheduled for 1961 service by American Airlines, Swissair, Scandinavian Airlines System and Real Aerovias of Brazil.

Avco's Nashville Division produces many important structural assemblies for Convair's latest luxury queen. The Nashville Division designed, tooled, and produced the Convair 880 wing tips, wing leading and trailing edges, rudder, elevators, and vertical and horizontal stabilizers, and has tooled and produced most of the same components for the Convair 990. Nashville's production capability has been proven through years of experience in providing structures to meet the latest advances in today's aircraft.

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the same general principles as the low-altitude system. It is also a complicated piece of equipment with a severe high-temperature materials problem. Its basic difference is that it requires a number of days to collect a load of 100,000 pounds or more of liquid oxygen.

Some type of electric rocket would be needed to power the high-altitude collection system to overcome its drag without a large expenditure of propellant. A nuclear reactor could provide power for the electric rocket and the air-liquefaction unit on a refueling station which could operate economically over long periods.

US development of nuclear engines for flight use finally is beginning to look both politically and technically feasible after more than ten years of slippages, arguments, and program redirections.

Three nuclear engine R&D programs are now in existence, two directed by the Atomic Energy Commission and the Air Force and the other by the AEC and NASA. The USAF-AEC programs are for a turbojet for manned aircraft and for a nuclear ramjet for supersonic missile application. The NASA-AEC program, Project Pluto, involves the development of a heat-exchanger, solid-fuel-type nuclear rocket *(see page 52).*

The oldest and most controversial of the US programs is the nuclear turbojet project. Its technical, management, and cost problems have been so severe that it has had strong opposition from segments of the military, the Congress, and the Administration.

Several technical problems with the nuclear aircraft have seemed almost insurmountable to a large number of scientists and engineers for years. One of the primary technical hurdles was the provision of adequate shielding for the crew. The magnitude of this task is illustrated by the fact that a ground-based reactor producing about 100 megawatts of power would require a shield more than twenty feet in diameter weighing about one million pounds. This is about the same power that will be installed in the first subsonic nuclear-powered aircraft, the Convair NX-2, which is scheduled to fly in 1965.

A second major technical problem of major importance is that this nuclear aircraft will have to produce fifty times more power for each pound of engine weight than the *USS Nautilus* does if the aircraft is to fly successfully. This weight requirement means that light and very efficient shielding will be required and that the shielding techniques used in other nuclear-energy devices will not be adequate for manned flight.

A third technical problem which has disturbed scientists is that hydraulic, electrical, and electronic subsystems all deteriorate quickly when exposed to strong radiation. Ten years ago tests showed that none of them would function much longer than 100 hours in the environment expected on the nuclear-powered airplane.

It is just becoming clear, through a gradual downgrading of the project's security, that all of the main technical questions had been answered as far back as 1957 and that it was possible then to build a subsonic nuclear aircraft. A year or more ago the scientific advisers of the Eisenhower Administration testified before Congress that there was no doubt concerning the feasibility of a subsonic atomic airplane. They also testified that they had rejected a program to build such an airplane because it did not have the capability or the growth potential to fly supersonically. Therefore they had reoriented the program to put more emphasis on obtaining better reactor and engine construction materials so that they could be operated at higher temperatures and provide enough power for supersonic flight.

This program reorientation was only one of many which have changed the objectives of the nuclear-airplane program about every two years since its inception in 1950. Originally the objective was to develop the technology needed for nuclear-powered aircraft. This was expanded one year later to include the demonstration of feasibility through the flight of a modified B-36 aircraft. The following year this program was dropped primarily by the action of Defense Secretary Charles E. Wilson. After a year of comparative inaction the Air Force got the nuclear-aircraft development going again as a strategic weapon system. The new program was to bypass the experimental or proof-of-principle flight test stage and produce a full-blown operational aircraft as the first nuclear-powered aircraft to fly. This effort, known as Weapon System WS-125A, was canceled two years later in 1956 because it could not compete with strategic missiles on a cost basis. In 1957 and 1958 the nuclear-aircraft project was kept alive, and its low-keyed activities were directed primarily at improving basic technology. In 1959 the main program effort was shifted to finding better reactor and engine materials. In 1960 the Air Force went ahead with plans to build two Convair NX-2 experimental nuclear aircraft and fly them in 1965.

A total of about $1 billion have been spent so far and another $1 billion will be needed for first flight. This expenditure is causing some opposition in Congress and parts of the military.

It is probable that either the nuclear ramjet or rocket will fly before the nuclear airplane. These engines present fewer problems and are less costly. Current experiments in these programs have been successful beyond expectation and the nuclear rocket probably will enjoy the highest priority because of its critical value to the space program.

There are essentially no doubts left over the feasibility of all three types of nuclear engines. Even if management indecision remains to plague development efforts, all of the engines should be flight tested within ten years. As these flight tests are completed, the way will be paved for the second generation of nuclear engines which are in the conceptual design stage now. According to their designers these engines will have greatly improved performance and utility and will make it possible and profitable to complete the transition to nuclear power on most flight vehicles.
—END

Left to right: Lt. Col. T. H. Miller, USMC; Vice Admiral W. F. Raborn, Jr., USN; J. D. Wethe, General Electric; Cmdr. J. F. Davis, USN; D. D. Clark, McDonnell Aircraft.

# G. E. trophy goes to F4H pilots

NEW ORLEANS, La.—The General Electric trophy for significant achievement in military aviation in 1960 has been presented to the U.S. Navy and the two pilots who set new world speed records with the Navy's McDonnell F4H Phantom II fighter.

Joint recipients of the award are Lt. Col. T. H. Miller, USMC, who set a new 500-km record of 1216 mph; and Cmdr. J. F. Davis, USN, who set the 1390-mph 100-km run record.

The trophy was presented Jan. 13 at a regional Navy League meeting. In making the award, J. D. Wethe, an executive of G.E.'s Large Jet Engine Department, cited "the outstanding capability of the Naval air arm and the pilots who fly the Navy's jets."

The F4H in which Lt. Col. Miller and Cmdr. Davis set the closed-course records was powered by twin G-E J79-2 test engines. The Phantom II is now flying with the J79-8, an improved production engine. The more powerful -8 produces over 16,000 lbs of thrust.

Its 12:1 compression ratio helps to make the F4H the Navy's fastest, highest-climbing, longest-ranged fighter. *For additional information on the F4H/J79, check GED-4106. See coupon.*

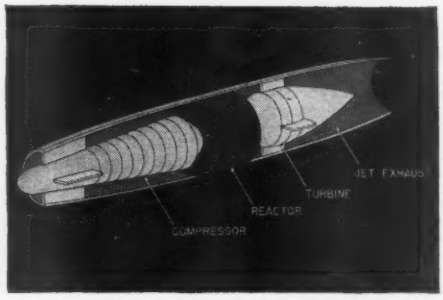
# GENERAL ELECTRIC BEGINS WORK ON FLIGHT-TEST NUCLEAR ENGINE

EVENDALE, O.—A high-performance direct-air cycle turbojet powerplant scheduled for flight testing in the mid-1960's is now under development at General Electric's Aircraft Nuclear Propulsion Department.

ANPD General Manager David F. Shaw announced the program recently, after two modified turbojet engines were successfully started and brought up to normal operating performance on nuclear power alone.

In previous tests, startup was accomplished with chemical fuel. The all-nuclear start established the feasibility of the direct-air-cycle nuclear turbojet, using nuclear fuel for the entire operation.

With the all-nuclear start, General Electric completed a series of Heat Transfer Reactor Experiments (HTRE) conducted during the past five years. The HTRE series demonstrated the practicability of the direct-air cycle system and resulted in the development of many of the components necessary for nuclear flight.




Schematic of a nuclear powerplant shows how a nuclear reactor could replace the combustion system of the familiar petroleum-burning jet engine.

General Electric is developing an advanced flight-test direct-air-cycle turobjet under contract to the U.S. Air Force and Atomic Energy Commission.

". . . It is no longer a question of can we build a nuclear-powered aircraft propulsion system, but when can we place such a system in an aircraft," Mr. Shaw said. "We have reached the point where we can say that when an airframe is ready, we can have a nuclear direct-air-cycle engine ready to install in it."

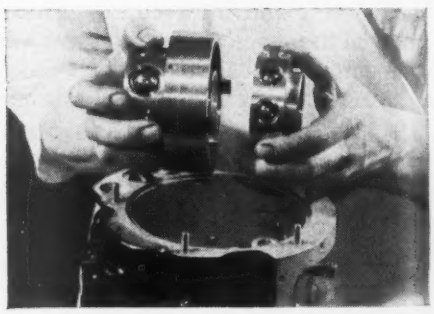
*For more details on aircraft nuclear propulsion advances, check GEA-7105. See coupon.*

# F4H Features Unique Hydraulic Constant Speed Drive System

LYNN, Mass.—A unique G-E hydraulic constant speed drive powered the electrical system for the McDonnell F4H Phantom II during its record speed runs.

Two parallel 20-kva drives transform the variable speed of the twin J79 powerplants to the constant speed required by the aircraft's a-c generators. The drives, which can "lock" together to divide load, maintain system frequency constant within ± one-tenth of a percent.

The G-E drive is a compact radial-piston hydrostatic transmission that features free spherical pistons rather than conventional restrained cylindrical pistons, connecting rods, and associated bearings. The simple design concept has demonstrated reliability of .9997 per hour in over half a million operating hours in other aircraft applications.



Small ball piston elements, key transmission components of the hydraulic system.

The General Electric F4H electrical system contains several innovations for U.S. Navy "production" aircraft, including:

- First application of an integrated drive-generator package.
- First application of oil-cooled generators to provide environment-free conditions.
- First "high temperature" drive, operating continuously at 300F.

*For more information about constant speed drives, check GEA-6890. See coupon.*

# NEWS

A report about progress in research and products from the Flight Propulsion Division of the General Electric Company

## CONVAIR 990 LOGS FIRST FLIGHT

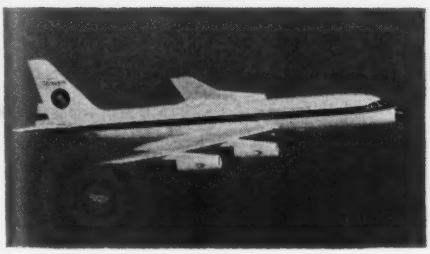
SAN DIEGO, Calif.—The first flight of a second generation jet airliner, Convair's 990 Coronado, was logged here on January 24 as the swift aft-fan transport climbed aloft on a 2-hour, 3-minute maiden flight.

Powered by four 16,100 thrust-class General Electric CJ-805-23 aft-fan engines, the 990 flew at speeds up to 500 mph and altitudes to 25,000 feet.

A medium/long range jet capable of operating from 5000-foot runways, the 990 is designed to carry 96-121 passengers. Cruising at 640 mph, it will be the world's fastest airliner, and is expected to cut transcontinental non-stop flight time by as much as forty-five minutes.

The aircraft is scheduled to enter commercial service in mid-1961. In addition to speed and short-runway advantages, 990/CJ-805-23 operators will benefit from improved specific fuel consumption and quieter engine operation.

*For more information on the Convair 990/CJ-805-23 check GED-4284. See coupon.*



**A single CT58 powers the Sikorsky S-62, with 10 passengers aboard, at 100 mph. S-62 will soon be in service for San Francisco-Oakland Helicopter Airline.**

## *Second California Airline to Offer Turbocopter Service*

SAN FRANCISCO, Calif.—San Francisco-Oakland Helicopter Airline recently announced plans to inaugurate Sikorsky S-62 turbocopter passenger service in the Bay area April 1, 1961.

Both the new airline and the Los Angeles Airways will be offering CT58 turbine-powered passenger service. The S-62 has serviced communities in the Los Angeles area since December. The new turbocopter has demonstrated its speed by flying 10 passengers from the Los Angeles airport to Azusa in 15 minutes—a distance usually requiring a 1-hour-and-40-minute drive.

M. F. Bagan, president of the San Francisco-Oakland line, said, "The excellent power-weight ratio of the CT58 engine and the proven components of this aircraft make the S-62 the most dependable helicopter ever built." Community spokesmen also commented that "its turbine engine makes it a very quiet aircraft."

Producing 1050 horsepower and weighing only 280 lbs, the economical CT58 weighs only 33% as much as reciprocating engines of the same rating. Fifty-five inches long, it requires only 25% of the space of similarly rated conventional powerplants.

Los Angeles Airways, New York Airways, and Chicago Helicopter Airways will fly turbocopters with twin CT58 powerplants in 1961.

*For more S-62/CT58 information, check GED-3987A and GED-4236. See coupon.*

## G-E lift fan completes 90 hours' operation

EVENDALE, O.—General Electric recently logged another important step in its lift fan flight test program, completing 90 hours of operation. Fifty hours of wind tunnel testing were included in the operation.

The lift fan will permit tactical military or commercial aircraft to take off or land vertically, yet cruise as present jets do. A lift fan-powered aircraft flight test is planned for 1963.

During the recent program, the G-E lift fan engine system, powered by the 2450 pound thrust-class J85-7 engine, was mounted in a wind tunnel aircraft mock-up.

General Electric engineers have discovered that the lift of the airplane/lift-fan combination is greater than the lift of either of them measured separately.

This additional "interaction" lift is attributed to the fan pulling air through from above, creating a force on top of the wing to give the vehicle this lift bonus. Interaction lift helps assure flight over varying flight conditions.

**G-E lift fan is designed for horizontal mounting in the fuselage or wings of VTOL aircraft. It is shown here in vertical position, during plant inspection.**

### FOR MORE INFORMATION

General Electric Company
Section D206-22
Schenectady 5, N. Y.

- ☐ GEA-6890 "Constant Speed Drives"
- ☐ GEA-7105 "Advances in Nuclear Aircraft Propulsion"
- ☐ GED-3987A & GED-4236 "CT58"
- ☐ GED-4106 "F4H/J79"
- ☐ GED-4284 "CJ-805 Progress Report"
- ☐ GER-1704 "F4H AC Electrical System"

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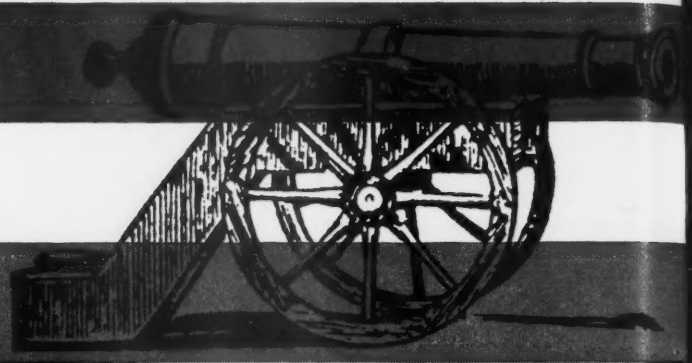
**At the turn of the century, just as today, there was a simple and obvious requirement for defense reorganization . . .**



Photos from the Bettmann Archive

US troops under fire in Spanish-American War battle of San Juan Hill. Bravery, confusion marked US war effort.

US commanders, robust General Shafter, bearded Admiral Sampson, land for council of war with Cuban leaders.

War Secretary Elihu Root saw need for postwar Army reorganization.

# . . . Defective at the Top'

HARRY HOWE RANSOM

*"The most important thing to be done now . . . is the creation of a General Staff. . . . Our military system is . . . exceedingly defective at the top. We have personnel unsurpassed anywhere. . . . We have wealth and a present willingness to expand it reasonably for the procurement of supplies and material of war. . . . We have the different branches of the military service well organized, each within itself, for the performance of its duties. . . . But when we come to the coordination and direction of all the means and agencies of warfare, so that all parts of the machine shall work true together, we are weak. Our system makes no adequate provision for the directing brain which every army must have, to work successfully."*

AT FIRST glance, the words above might reasonably have come from a task-force report to President John F. Kennedy on higher defense organization in this year 1961. Actually they are excerpts from the Annual Report of Secretary of War Elihu Root—in 1902.

Secretary Root wrote these words in the midst of a stormy—and finally successful—struggle to create a General Staff within the United States Army.

The fight to reorganize the Army at the turn of the century offers an interesting and significant parallel to the current controversy over defense reorganization, particularly with reference to the general staff question. The parallel is twofold. First, the United States at the turn of the century—as now—was entering a new era in world politics and military technology. This called for a more unified military structure. Second, the arguments against the general-staff concept in 1902-03 are strikingly similar to those heard now.

The basic issue in 1902-03 was between those defenders of the organizational *status quo*, marching under a moth-eaten banner reading **NOTHING SHOULD EVER BE DONE FOR THE FIRST TIME,** and those proposing reforms derived from a logical analysis of the existing situation. The same issue divides us today.

Among the most important and controversial proposals in the preinaugural report of President Kennedy's task force on defense organization, headed by Senator Stuart Symington, was that the existing Joint Chiefs of Staff be reconstituted into a Joint Staff under a single chairman (*see* AIR FORCE, *January '61, pp. 38-41*).

The striking analogy between 1902 and today can be seen by comparing reactions to the Symington group's recent proposals with those which greeted Elihu Root's plan for an Army General Staff at the dawn of the twentieth century.

A Navy admiral, as quoted anonymously by *Business Week* (December 24, 1960), commented on the recent proposals of President Kennedy's defense organizational task force as follows:

"It's dictatorship, and contrary to everything that's American. It violates constitutional principles of government organization which guarantee the separation of powers, checks and balances, and protection for minority views."

Turn the calendar back more than half a century and listen now to the view of the Commanding General of the Army, reacting to War Secretary Root's proposed Army General Staff:

"In my judgment . . . [an existing] system that is the fruit of the best thought of the most eminent patriots and ablest military men that this country has produced should not be destroyed by substituting one that is more adapted to the monarchies of the Old World. . . . The scheme is revolutionary, casts to the winds the lessons of experience, and abandons methods which successfully carried us through the most memorable epochs in our history."

These are the words of Gen. Nelson Miles, fore-

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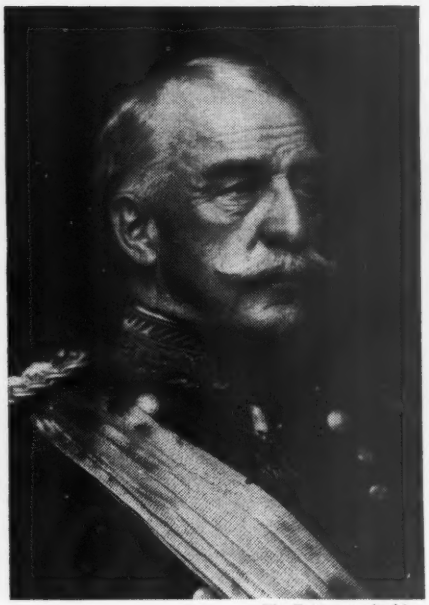


The Bettmann Archive

**Army chief, Gen. Nelson Miles, was traditionalist foe of Root's plan.**

The Bettmann Archive

**Spanish-American War was full of sound and smoke, signified need for new US military organization. Here Marines bombard Spanish position in eastern Cuba.**

## THE SAME OLD STORY

**When Secretary of War Elihu Root reorganized the Army in 1902-1903 he ran into the same problems and the same arguments that color the current unification controversy:**

- ★ **"Nothing should be done for the first time."**
- ★ **"Today's system served us well in the past."**

**But the problems lie in the future, not in the past. Unless we act now, we cannot solve them.**

telling to the Senate Committee on Military Affairs in 1902 the dire consequences to the nation if Root's general staff proposal were adopted.

Fundamental changes in the military establishment, as Gen. Billy Mitchell once observed, seem to come only after disaster in war or from an aroused public opinion. Elihu Root's reorganization of the Army in 1903 stemmed from shocking inadequacies of the armed forces demonstrated in the Spanish-American War in 1898. Disaster was averted and the war won in a short time because the Spaniards, as Mr. Dooley observed, were "in a trance." But the war revealed the Army's basic organizational defects. Elihu Root was aroused, and he set about to arouse public opinion in support of Army reform.

The current controversy over defense reorganization can perhaps be seen in a clearer light by viewing in perspective Elihu Root's earlier fight to establish a general staff.

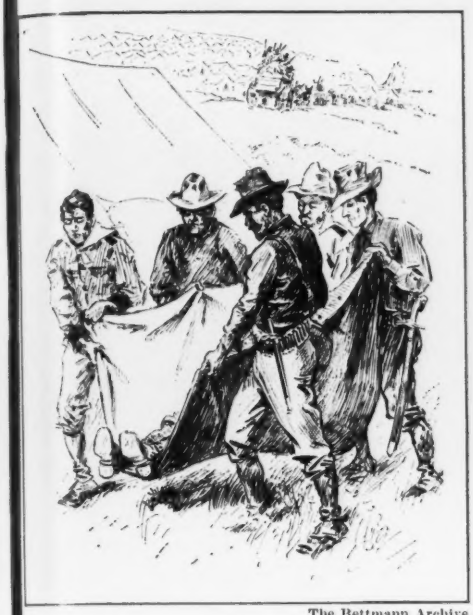
The war with Spain may have been a "splendid little war" to Col. Teddy Roosevelt of the Rough Riders, yet the performance of the Army in that war was something less than splendid. Certainly it was a tragic experience for those Americans who were killed or maimed in the battle for Santiago, Cuba, or who died or suffered from the incredible mismanagement of the military establishment. Army deaths from disease, for example, exceeded battle deaths by more than seven times.

For many of the war's participants, as Harvard historian Frank Friedel has observed, "It was as grim, dirty, and bloody as any war in history. It was a little war, but only the incredible ineptitude of the Spaniards and the phenomenal luck of the Americans kept it from stretching into a struggle as long and as full of disasters as the Boer War became for the British."

In spite of the lessons which the Civil War might have taught, the War Department on the eve of the Spanish War maintained an organization more attuned to Indian warfare on the frontier than to the requirements of an emerging world power. Consequently, the United States performance resembled a combination of a Gilbert and Sullivan operetta and the Keystone Cops. This is not to overlook the idealism and heroism of the thousands of Americans who fought and suffered.

It soon became clear that organizational deficiencies were a central cause of glaring ineptitude and shocking inadequacies.

The fact that the war was reported by hordes of newsmen and that the greater part of the task force was made up of civilian volunteers—some of them politically influential—meant that the nation quickly learned that "something was rotten in the War Department." A postwar presidential investigation, headed by Gen. Grenville Dodge, issued an eight-volume report on the war's conduct. Among other things it noted: divided authority and responsibility in the upper echelons of the War Department; basic planning failures in training, equipment, and logistics; and the lack of foresight and of even elementary



The Bettmann Archive

**Sad scene in camp. More American soldiers died of disease than of bullets in war.**

The Bettmann Archive

**Poor medical care, "embalmed beef," improper uniforms were often lot of US fighters in Cuba. Public scorn, witness this cartoon, was directed at Army.**

strategic planning, including the absence of coordinated information and programing.

The public came to learn of troops dispatched to tropical Cuba clad in heavy woolen winter uniforms, to be fed "embalmed beef," and to receive shockingly inadequate medical care. Ships transporting troops to hostile shores possessed no adequate landing craft. Soldiers were equipped with obsolete weapons, the ammunition for which emitted great clouds of black smoke, while the Spaniards were equipped with Mauser rifles and smokeless powder. The land war was waged virtually without plan. On top of this the Secretary of War and Commanding General were not on speaking terms—the outgrowth of years of divided authority.

The heart of the problem was early diagnosed by Theodore Roosevelt. The day after he was commissioned, he noted in his diary: "There is no head, no management whatever in the War Department. Against a good nation we should be helpless."

Elihu Root fortunately appeared on the scene in 1899 as the new Secretary of War—one of the ablest men ever to occupy that post. Root began the job with the conviction that the war with Spain had, in his words, demonstrated "inefficiency and corruption in the War Department."

The basic structural problem was that the War Department was a multiheaded creature. The three major focuses of power and authority were the Secretary of War, the Commanding General of the Army, and the diffused authority to be found scattered among the chiefs of the bureaus and subdepartments, such as Ordnance, Quartermaster, Inspector General, etc. This latter assortment of semisovereign satrapies was independent of the Commanding General. Each of the supply and service units was headed by a permanently assigned chief, who worked to entrench the position of his domain by carefully cultivating support on Capitol Hill. Often such a chief's power was greater than that of the Secretary of War.

Secretary Root, a New York lawyer, carefully studied our existing structure and various foreign military systems. He rejected the wholesale adoption of the German or French staff system, recognizing that the US required its own brand of military organization. But he became convinced that the Army required a General Staff, American-style. Only this could bring the needed unification of intelligence, strategic planning, and central direction to the various elements of the Army.

The War Secretary saw the corollary requirement for strengthening the hand of a proposed single Chief of Staff relative to the chiefs of the various supply and service bureaus. He also recognized the need to strengthen the authority of the Secretary of War over both. Root worked hard to publicize Army organizational defects and to overcome widespread internal War Department opposition by circulating and patiently explaining the arguments for reform. Meanwhile, by executive order, he created the Army War College, to function as something of a General Staff until Congress could be persuaded to adopt his reorganization.

As Root moved cautiously but with determination toward reform, he expectedly encountered the opposition of the Commanding General. Nelson Miles had as allies most of the bureau chiefs and their potent array of supporters on Capitol Hill. To destroy this opposition alliance, Root succeeded, in 1901, in the statutory elimination of the permanent detail of officers as bureau chiefs. Thereafter they served four-year terms.

Root's General Staff bill was submitted to Congress in 1902. Essentially it called for a Chief of Staff as the unchallenged military head of the Army, thereby eliminating the post of Commanding General, and placing the bureau chiefs under the specific supervision of the Chief. Also provided was a General Staff corps to assist the Chief in central mobilization and war planning. The military command authority of the Secretary of War was also to be strengthened. Under

*(Continued on page 63)*

**Opening Radiant "Windows" to the Universe** . . . Man's world has been compared to the inside of a dark room: his only view outside has been through a tiny window in the wall.

This analogy is accurate. Visible light, for example, is only about 3% of the entire electromagnetic spectrum—the radiant energy that fills our world with life. What we know about the other 97% is little indeed, despite the centuries men have wondered, probed and experimented. Our "windows" are small and often the view is obscure.

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the new system command authority would be exercised by the Chief of Staff but under the authority of the Secretary of War, agent of the President. The new system would require mutual confidence between Chief of Staff and Secretary of War.

As expected, opposition to the congressional bill was led by Commanding General Miles. He flailed the proposal as un-American, revolutionary, and an unwarranted risk. His basic argument was that the nation had won all of its wars under the existing system. So why risk change? This was to become the copy-book maxim for opponents of unification in later years. With such arguments Congress was persuaded to postpone action.

Secretary Root's persistent, eloquent, and politically astute campaign to give the Army a central brain and unified direction bore fruit the following year. But not without another skirmish on Capitol Hill.

In the House debate on the measure, Congressman Theodore Kluttz of North Carolina echoed the sentiments of the Commanding General and some of the bureau chiefs:

". . . We can better trust our generals in the field, as shown by experience, than a board or staff, sitting here in Washington, moving them about like men on the chessboard. . . . I can see no reason for setting aside the lessons of experience for an untried experiment. . . ."

Amidst "loud applause" Mr. Kluttz expressed a sentiment voiced so often in later unification debates. An Army General Staff, he said, "would set up what might be an oligarchy in the War Department. . . ." The applause may have been loud, but it represented a minority. Root's work had been well done, and the bill, with amendments, was passed in the House by a three-to-one margin. It met similar success in the Senate.

Although the heart of Root's proposal was adopted, Congress insisted on some compromises, a trait to become a familiar pattern in subsequent unification battles. (*See* AIR FORCE, *February '61, pp. 38-41*).

For example, Congress failed to eliminate the independence of the Inspector General's Department which Root wanted to transfer to the new General Staff. Other compromises left some of the bureaus—such as Brig. Gen. Frederick Ainsworth's Records and Pensions Bureau—with potentially independent authority. This was a harbinger of later bitter struggles to achieve fuller unification in the War Department. Another able New York lawyer, Henry L. Stimson, had to be summoned in 1911 to put things into better order as Secretary of War under President William Howard Taft. But that is another story.

After a three-year struggle against supporters of the *status quo*, Elihu Root had succeeded, in spite of the compromises, in achieving a significant reform in the Army system.

What are the lessons? Some say that all that history teaches is that history teaches nothing about contemporary and future events. A possible contradiction of this is that the arguments in the military reorganization issue have changed little over the past half century. As we have seen, Elihu Root, a type of civilian secretary all too uncommon, carefully analyzed the new position of the United States in the world at the turn of this century, and studied the consequent new military and strategic requirements and their organizational implications. Out of this came his proposals for a General Staff.

These were opposed with the same tenacity and with many of the same arguments that greet current proposals for unifying our general staff planning system. Modern-day proposals, like Root's earlier ones, stem from careful, objective analyses of the new position of the United States in world affairs and the new technology of warfare.

Opposition to change stems not only from a perhaps unconscious belief that **NOTHING SHOULD EVER BE DONE FOR THE FIRST TIME** but also from a fear of the unknown or untried or from a feeling that the privileges and prerogatives of those commanding the existing system might be upset or disarranged. One hears the argument proclaimed again and again that the existing system "has served us well in the past." Normally it has served well the spokesmen who defend it. Indeed the existing organization may have served the nation well in the past. Yet any discussion of reorganization should concern itself with the future, not the past. As each word here is written, the present becomes the past. Unless we act now, we cannot expect to have the new organization which surely will be needed in the future.

The existing compromise defense organization represents the patchwork of reorganizations between 1947 and 1958. Many admirable accomplishments in defense have been realized in spite of the system. Yet it has been responsible for perpetuating expensive interservice rivalry and duplication, for prolonging beyond belief decisions on critical strategic questions, for risky delays in the development of new weapons and procedures, and for other shortcomings having a deleterious impact on national security.

The Symington panel plan is a logical step toward unification. It would strengthen the decision-making authority of the Secretary of Defense, reorganize the JCS into a general staff with a single chief, deemphasize the semi-independent role of the separate services in strategic planning and military operations, and would clarify and strengthen military command and control.

Those who label such proposals as "dictatorship" and un-American would do well to note the story of the 1902-03 Army reorganization. From the perspective of half a century one is struck by the speciousness of the arguments then against the general staff concept and their similarity with modern-day arguments against change.—END

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*The author, Dr. Harry Howe Ransom, a political scientist, has been a senior staff member of the Defense Studies Program of the Graduate School of Public Administration at Harvard University since the program was set up in 1955. Dr. Ransom is the author of the 1958 book* Central Intelligence and National Security *and many articles on defense subjects. Harvard's defense group has played an important role in stimulating thought in this vital field.*

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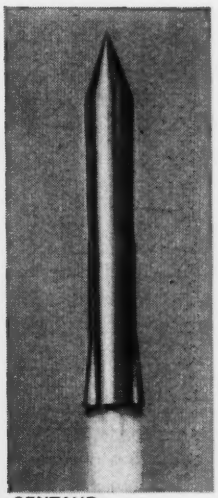

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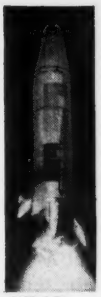

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- VENUS STUDY
- TALOS
- NAVY ASW FIRE CONTROL
- POLARIS

**SIMULATION AND LOGISTIC SUPPORT**
- CENTAUR
- BOMARC-B
- ASROC
- SUBROC
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- F-106A
- A3J-1
- F8U-1 & 2
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# SAFETY IN NUMBERS

**A SPECIAL CONTRIBUTION**

THE STRATEGIC experts are having a field day. Most have convincing stories. Most have identified real weaknesses in our defense structure. Most propose remedies which should have been obvious to the Defense Department years ago—and which, in fact, would have been obvious *if* there had been adequate funds.

They elaborate on concepts such as invulnerability, concealment, hardening of missile sites, mobile missiles, airborne alert, warning, and technological acceleration. These measures are necessary. But they are only partial solutions, essentially devices or subsolutions.

It is difficult to decide how much money to spend on each of these worthy programs. Consequently, one must determine priorities. Is warning more important than hardening? Is airborne alert more vital than mobility? Should you buy more Polaris submarines now or spend more on acceleration of nuclear-propelled aircraft development?

Such decisions, in reality, are not half so difficult as they may appear, once fundamental priorities have been determined. The military experience of past centuries is conclusive as to what the truly decisive factor in conflict really is. It is quantitative superiority. Frederick the Great is said to have told Voltaire that he won a particular battle because God was on his side. "God is on the side of the stronger battalions," Voltaire replied.

What does this age-old principle of superiority mean today? Very simply it means that in the era of the missile- and aircraft-delivered nuclear weapon, the relative size of the forces after a first strike will determine the outcome of war.

This principle can be expressed in various terms such as "surviving firepower," "sustaining power," and "surviving strength." The key to having the greater relative strength is numerical superiority. We have seen tacit recognition of this fact in various substrategies such as hardening, air alert, mobility, and concealment. Their objective is to give us forces which survive, forces which after a first strike will be relatively stronger than those of the enemy. The in-being peacetime force must be large enough to meet this requirement.

We can see the importance of relative numbers through several examples. First, let us take a case in which the Soviet Union has twice as many missiles as we—say, 100 missiles on their side compared to fifty on ours. It is obvious that they could bring two missiles to bear on each of our sites. Given even a reasonable probability of success they could eliminate our missile force in one surprise blow; however, if we look at the reverse case in which we have a two-to-one advantage over them, that is, 100 missiles for us and fifty for them, it is obvious that it would be impossible for them to launch a successful surprise attack against us.

These two examples are further complicated by the substrategies already mentioned. If we have a two-to-one advantage over the Soviets and adopt measures now as an integral part of our program—such as hardening, mobility, and dispersal—the Soviet's numerical inferiority would pose for them an even more difficult problem if they were to attempt to achieve surprise. The numbers of missiles in the nuclear exchange are important in themselves, and the problem of the planner of aggression is further complicated by these additional measures.

However, we must keep in mind that missiles are only one part of our strategic force. Our strategy is based on the concept of a mixed force of missiles and manned aircraft. To destroy this force in a surprise attack, the Soviets could plan to use one missile against each air base. This is so because air bases are, and probably will

*(Continued on page 69)*

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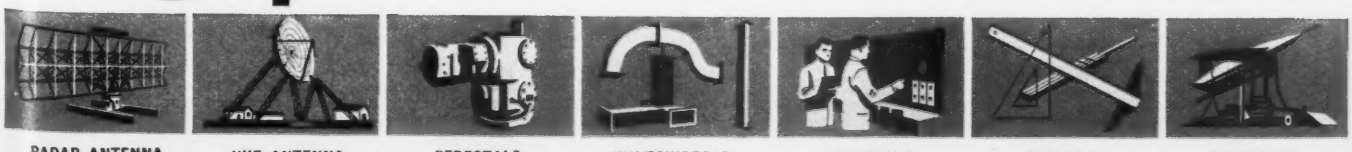

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be, in a soft configuration. That is, they will be vulnerable to attack by a single missile. This is not true for missile sites, which we are hardening. Performance characteristics such as accuracy and yield determine the number of missiles which the Soviet planner must allocate to assure destruction of our hardened sites. At the present time and for some years to come, it seems reasonable to assume that he must allocate two to three missiles for each hardened site. If the Soviet planner is in a position of numerical inferiority, it is obvious that he cannot successfully launch a surprise attack. Conversely, to launch an attack at a time when he believes he can succeed, he must plan to have the numbers of missiles in a ratio of two to three times greater than our force.

If we accept the need for numerical superiority, we still face the problem of determining how much relatively greater strength we need. This is in large measure a problem of intelligence collection and evaluation. Nevertheless, some rough standards can give us clues as to our relative positions. For example, if we look at the expenditures for missile forces in the Soviet budget and our own, we can extrapolate data on the relative number of missiles on sites. As long as we are spending proportionately more than the Soviets, we can conclude that we are building a numerically superior force. The budget itself thus provides an index as to where we stand. Other indices are available and we should exploit all of them for the purpose of determining relative superiority.

Our principal strategy must be to ensure surviving numbers. We must have strength such that even if the aggressor were to use all his weapons for strategic attack upon the United States, we still would have enough weapons to defeat him. The guarantee (not pious hope) that the remainder of our force will be strong enough for that purpose can be achieved only if we maintain quantitative superiority.

We must avoid gambling our security on the chance of success by any of the substrategies. This is so because concealment may be nullified by technology, because hardening may be too soft, because mobility may prove illusory, because the airborne alert may not work, because warning may fail, because the new weapons may not be available in time, and because human judgment is too poor to risk cutting the strategic cake too thin. These concepts are clever, *but they are not dependable.* The only dependability lies in superiority in numbers. Missiles can be used *only once.* Hence, superiority in their numbers has achieved a significance it *never* had before.

We want to make the United States dependably, not just probably, safe. Hence, we need numbers. But he would be a foolish strategist who tried to match the opponent in every category of weapons according to an inflexible algebraic formula. Perhaps our proper mix would be to have half as many missiles and three times as many aircraft, or, conversely, three times as many missiles and half as many aircraft. Furthermore, we may find that we should mix numbers with hardening and mobility. Also, because technology is dynamic, we cannot rest in the search for weapons with improved quality over those we now have and foresee. We also must consider a proper balance between offensive and defensive weapon systems and between military systems and civil defense.

Whatever we may do and however we measure forces in being, our national instinct should be taught to rebel against any choice which would cut the quantitative differential between friend and foe too finely. Let us adopt a coefficient of security. If the enemy's strength is described by the number N, our quantitative strength should be N x M. During the nineteenth century, the British always maintained a seapower coefficient of security. This coefficient was about two. The British policy was known as the two-power standard. That is, the Royal Navy was maintained at a strength greater than that of the second and third largest fleets combined.

By improving our quality, we might find it possible to reduce the coefficient of security to 1.7 or 1.5 or even 1.3. But any strategy that puts it below one is disastrous, irrespective of the most persuasive rationalizations about compensating qualitative factors.

A basic strategic decision is whether we merely want to *deter* or whether we want to *prevent* hostile nuclear aggression. A strategy of deterrence takes its chances with the enemy's psychology. It is derived from a defensive state of mind. It is permissive and "other-directed." This accounts both for its popularity and its effectiveness. When any one of us visits a house which is guarded by a vicious dog, we are usually not satisfied with the hope that we might "deter" the beast from biting us. We want the owner to keep the dog on a chain. We want to prevent the dog bite, and we don't want to be in any doubt about the matter.

Hardening, mobility, alert, warning, technological superiority, and all the rest, indeed, may deter the aggressor, but can we depend on them?

Freedom can prevail only if aggression is reliably prevented and if the rest of the world knows with great assurance that the Communists will be defeated if they attack the United States.

Numerical superiority is the price we must pay for the prevention of nuclear war. This is the elementary truth on which our strategy must be based and which must determine the magnitude and direction of our military expenditures. Adoption of this principle would solve in one stroke the key US defense problem which so far has proved to be insoluble—how to create a US second-strike force which can win on the rebound.

What is more, a strategy aimed at quantitative superiority is one which the enemy will understand best and which he will misunderstand least. It would be the most persuasive strategy which we could adopt to get the Communists to abandon their plans for world conquest. Moscow knows better than Washington that the United States and the free world have the economic strength to win a strategy aimed at quantitative superiority. The Soviet bloc could not bear embarking on such a course. It could never win the contest. It could never risk the necessary economic privation which would be of such magnitude that it might spell the doom of the Communist regime.

If the Kremlin then saw the point, the Communists might reduce their armaments. This would enable us to cut our own expenditures in turn. So in the end, the strategy of quantitative superiority might prove less costly than other alternatives. Most of us have found that it is usually cheaper in the long run to buy more expensive shoes and clothes than so-called cheap goods, and that it is always cheaper to buy a car which is in perfect mechanical condition. There are certain wares which a reasonable man does not buy at cut-rate prices. The United States is worth the most dependable security we can acquire.—END

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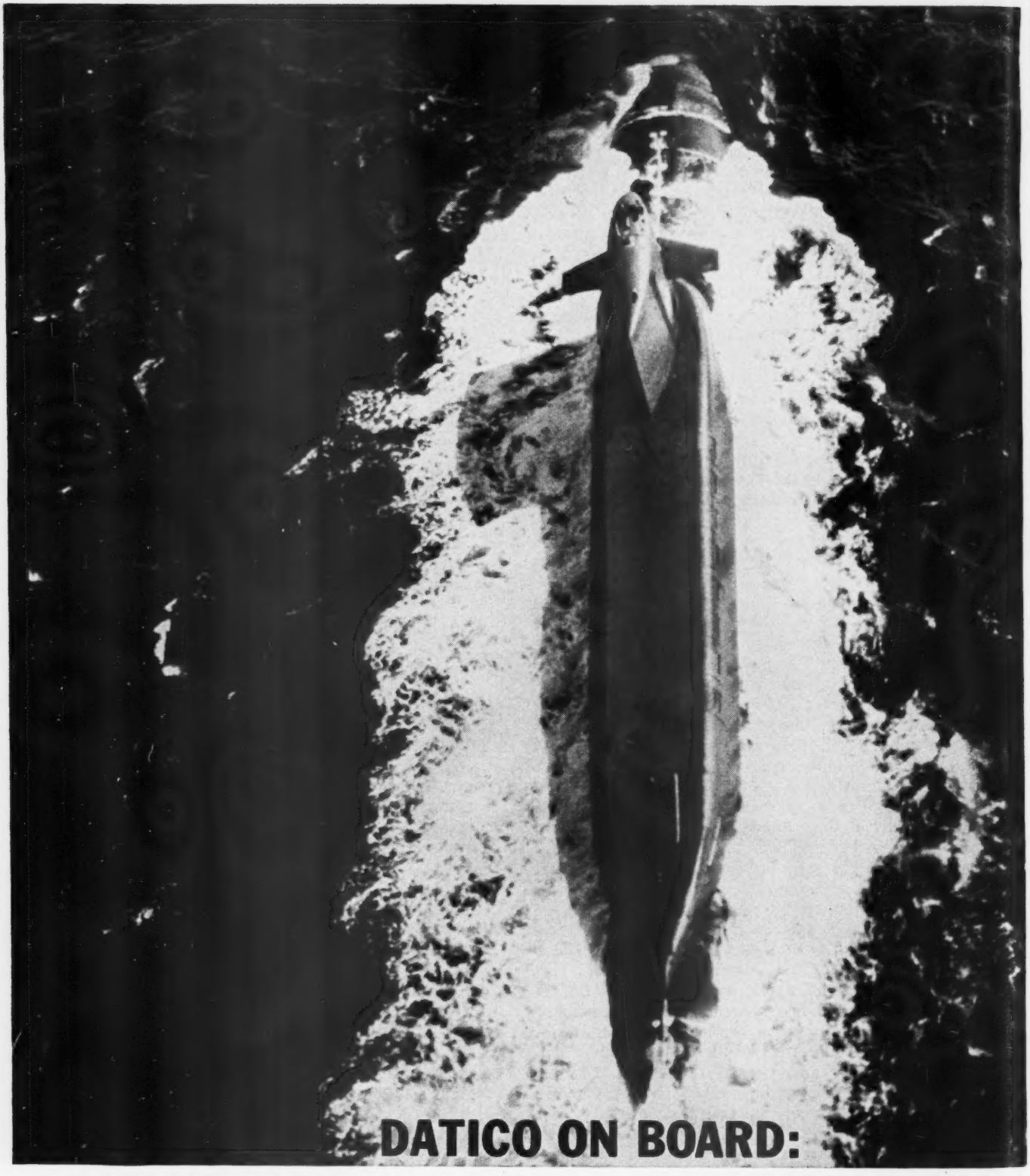
*This article represents the collaborated effort of two outstanding military analysts who, because of their official positions, prefer to remain anonymous.*



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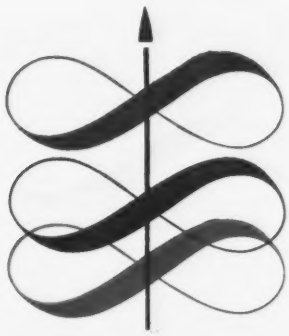

# SPACE DIGEST

*VOLUME 4, NUMBER 3* • *MARCH 1961*

Long Ride for a Game Chimp
*Claude Witze* ..... 73

Three Theories on the Craters of the Moon
*John W. Macvey* ..... 74

James E. Webb—New Boss at NASA ..... 80

Teaching Machines—Bane or Blessing?
*Charles M. Weisenberg* ..... 84

Speaking of Space
*William Leavitt* ..... 91

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*Up and out, Ham, atop the Redstone, blasts off.*

*Picked up at sea, capsule lets down on deck of* USS Donner.

*Medics look Ham over after ride aboard the* Donner.

# LONG RIDE for a GAME CHIMP

CAPE CANAVERAL, FLA.

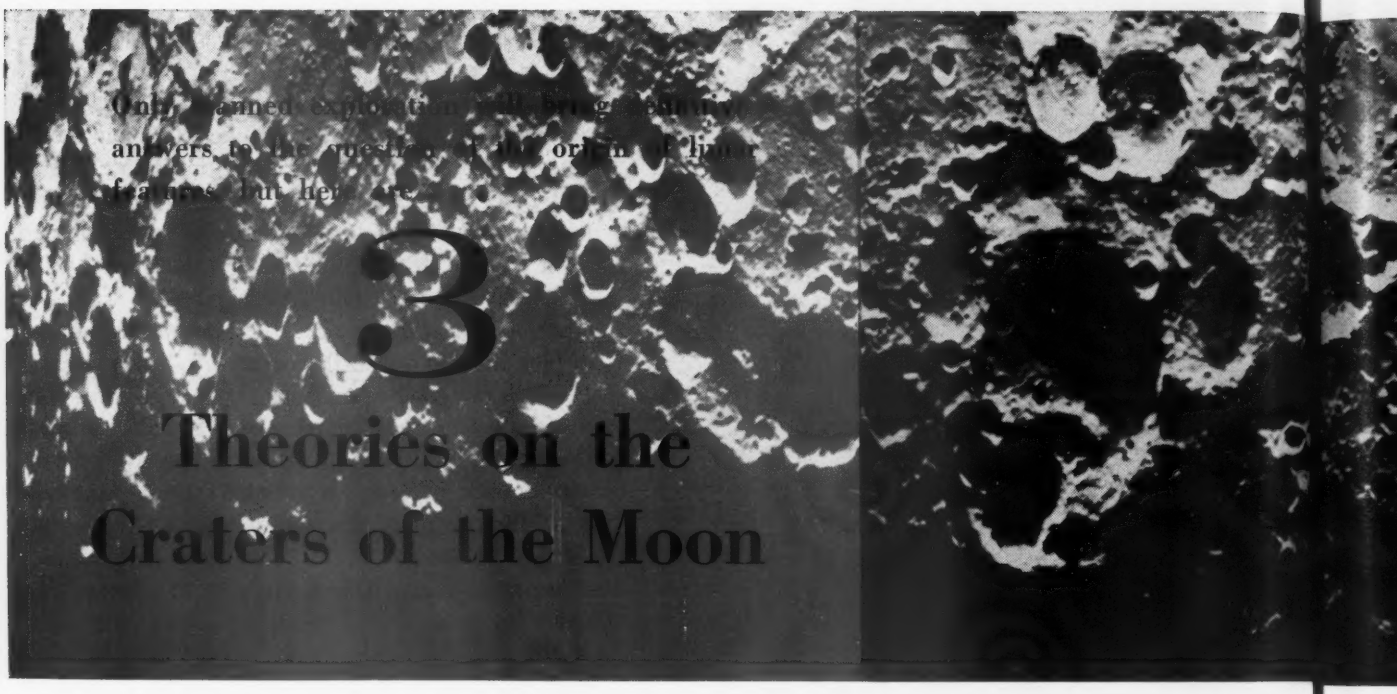
HAM, a freckle-faced and bow-legged chimpanzee, didn't get much sleep the night before he proved that an Astronaut can take at least a short trip into space. He was selected for the job at 8:00 p.m. and had only a short rest before, at two o'clock in the morning, USAF doctors started to give him a final physical checkup. From here on he was busy, being strapped in his couch and carefully transported with police escort to the Redstone launching area, where he arrived at 5:25 a.m. and was taken up in an elevator to be installed in the Mercury capsule.

The animal sat there until 11:55 a.m. Then he went into space. He hit a velocity of 5,800 miles an hour, a peak altitude of 156 miles, and landed 414 miles away in the Atlantic. From the sandy spot 9,000 feet away from where the press watches shoots, the takeoff looked flawless. As a matter of fact, it wasn't. The National Aeronautics and Space Administration didn't intend that Ham should go so fast, so high, and so far. But a thrust regulator—a throttle—was jammed open at liftoff, and the chimp got more push than was planned. This didn't bother Ham as much as it inconvenienced the Navy units waiting to pick him up out in the ocean. He landed nearly 120 miles beyond where they expected to find him.

Ham's trip took sixteen and a half minutes. During the ride he did his work except for two two-second periods—when maximum acceleration and reentry stresses were imposed—and didn't even hesitate during six and a half minutes of weightlessness. The chore was to operate two levers in front of a panel equipped with red, white, and blue lights. When the red light went on Ham knew from his training at USAF's Holloman Aeromedical Field Laboratory that he was on the job. He could flash the white light by pushing the right lever. If he failed to do so he would get a slight electrical shock in the foot. To stay shock-free he had to push the lever once every twenty seconds. Every two minutes the blue light went on for five seconds. He had to move the left lever in this five seconds and turn off the blue light to avoid a shock from that side. In training Ham hit this lever on an average of less than a second after the blue light went on.

Ham's good performance appears to have convinced NASA's Project Mercury officials that one of their seven Astronauts can duplicate the feat. At the same time, they have expressed some caution in view of the throttle malfunction and the fact that this resulted in an unscheduled test of the abort system. The escape rocket was prematurely ignited, and the booster jettisoned in normal sequence, but the retrorockets were not fired and the capsule sailed on to a full trajectory. It now appears likely that there will be other tests, perhaps with instruments or another primate. NASA still is confident it will send a man into space within a few months.

The fact that Ham has been up and down again and that a human will follow him soon still are early steps in the program for manned operation of a vehicle in orbit. Man in space will have far more to accomplish than a chimpanzee playing with red, white, and blue lights. The mission will be vital to national security.—CLAUDE WITZE



# 3

# Theories on the Craters of the Moon

*JOHN W. MACVEY*

OF ALL the lunar features, those exciting the most interest are the so-called craters, those odd formations which are spread so widely, and—as it seems at a cursory glance—so haphazardly over the surface of our satellite.

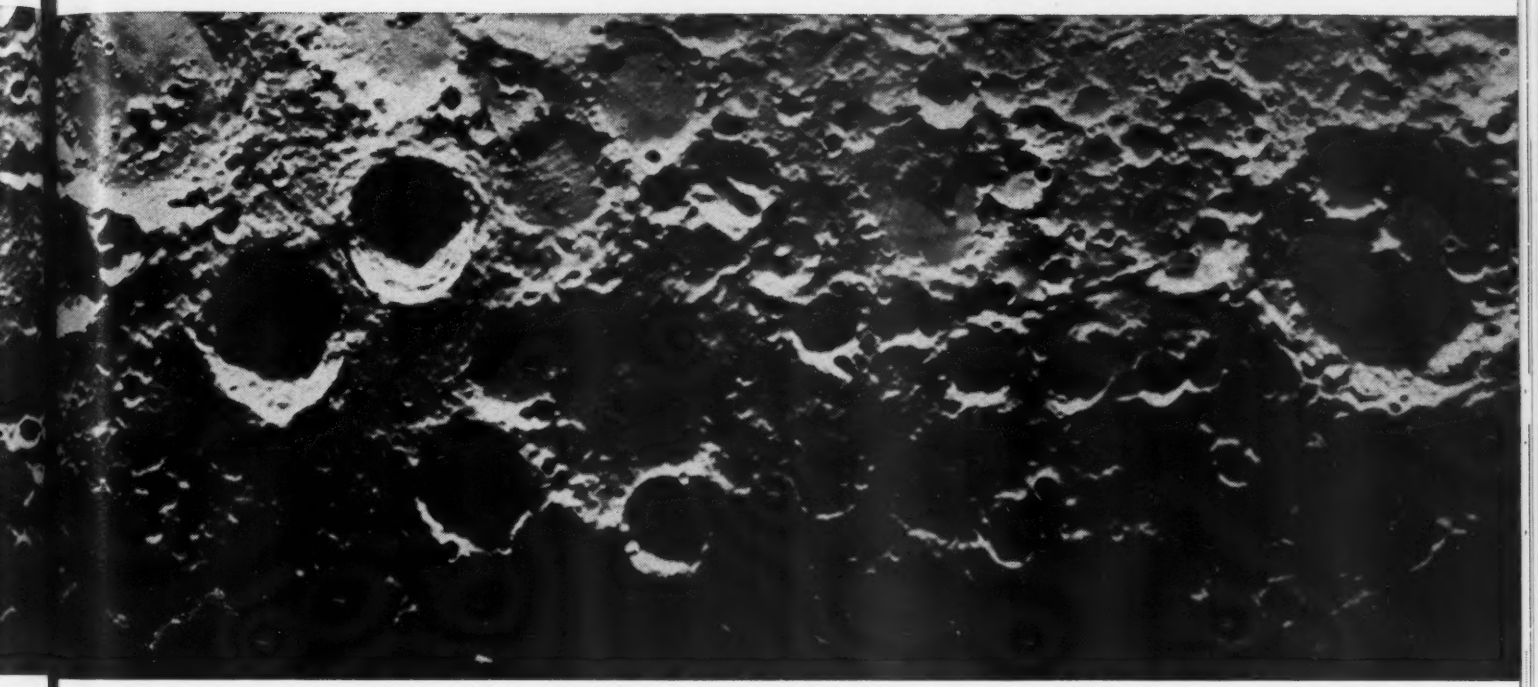
Quite a number of interesting theories seeking to account for them have been postulated over the years. Of these, three stand out as having possible validity—namely the volcanic, meteoric, and plutonic theories.

## The Volcanic Theory

This theory was first postulated by Nasmyth and Carpenter in 1874 and for a time gained a considerable number of adherents. It must be admitted that the use of the term "crater" in the first instance was probably somewhat unfortunate, inasmuch as it was almost bound to lead to attempts to prove that these objects were in fact craters in the terrestrial and purely volcanic sense.

In essence, the theory envisages a central volcanic "pipe" or outlet. Originally eruptions would be of a violent nature with the outlet acting rather as a "volcanic fountain," throwing out lava to a considerable distance over 360 degrees. This, it was suggested, resulted in an outer ring wall of appreciable dimensions. After a period of time, eruptions would become much less violent, thereby giving less impetus to the fountain and creating walls of lesser dimensions within the perimeter of the outer ring walls. In its dying stage, the volcano would be left with little energy, sufficient merely to raise molten lava to the lip of the orifice and there spill it out, thus creating the central peak. In the case of craters having no central peak it was further postulated that the eruption ceased quite abruptly so that the crater floor was covered by lava which welled up from within the moon's crust.

This theory, it seems, would certainly have validity in explaining such features as crest craters on lunar mountain tops, terraces, lava-flooded craters, and perhaps some of the plateaus such as Wargentin. By and large, however, the theory would appear to fail in several other respects. It is a fact that the large majority of lunar craters bear little or no resemblance to terrestrial volcanic craters. Fundamentally a volcanic crater is a hole on top of a mountain which is itself generally much higher than the surrounding terrain. Most volcanoes on earth, such as Vesuvius, Etna, or Stromboli, have been mountains throughout recorded history, and it is diffi-



cult to plot the course of their growth with much accuracy. The evidence of the resultant growth, however, is strangely at variance with the formations on the moon which, rightly or wrongly, we have termed craters.

In Mexico, a new volcano, since named Paricutin, did actually come into being in 1943, sprouting unexpectedly in the middle of a field. A great deal of solid material was ejected violently but in fairly haphazard fashion and nothing like ring wall formation took place. The new volcano confined its attentions very largely to the creation of its own cone, which within a year grew to a height of 1,200 feet above the plain, with a base thickness of three-quarters of a mile. In this and other volcanic formations here on earth, the essential feature is generally a single cone composed largely of volcanic ash and solidified lava. In addition, the sides bear the mark of successive lava flows. In the case too of a terrestrial volcanic crater, the shape is roughly that of a funnel and if it is of the "extinct" or long-quiescent variety, considerable weathering will probably have occurred. In both cases the outline of the crater is far from being circular or elliptical as are those on the moon, a fact to which any visitor to the summit of Vesuvius will readily testify.

It should be noted too that the diameter of the crater of the largest volcano on earth is only of the order of one mile, while that of the largest known eroded crater is only in the region of ten miles. These dimensions are pitifully small when contrasted with those of the large number of lunar craters which range from ten to 150 miles in diameter. It is, for example, very hard to envisage a volcano of magnitude sufficient to have created the ring wall of Clavius which possesses a diameter in the region of 100 miles. Indeed, if an observer on the moon were placed near the central peak of such a formation, the "crater walls" could be so far distant as to be indiscernible beneath the lunar horizon.

Furthermore, on earth, volcanoes are arranged along weak lines in the planet's crust—the so-called volcanic-earthquake belt. This is really a system of two well defined zones, one being the rather picturesquely named "Pacific Ring of Fire," which includes the Andes, Central America, the Rockies, Aleutians, Japan, the Philippines, the New Hebrides, and New Zealand. The other comprises the East Indies, Malaya, Burma, East Africa, the Mediterranean, the Azores, Canaries, linking up finally with the West Indies. While the distribution of the lunar craters is most assuredly *not* random as was once popularly

supposed, there is nevertheless a lack of the fine definition shown by the volcanic belt on earth. However, the distribution of the lunar craters would seem to conform to a certain degree of system, a fact which adds no little weight to the plutonic theory of crater formation.

It is also noteworthy that many craters without central peaks show no evidence of flooding by later lava emissions, yet one of the fundamental tenets of the volcanic theory was that in the absence of a central peak the crater floor is (or should be) covered by a lava flow. A further point which must inevitably go far toward refuting the volcanic theory is the fact that of the lunar craters which have a central peak, the peak may attain the height of the surrounding terrain but never that of the crater wall itself.

It seems, therefore, that although there must almost inevitably have been a certain amount of true volcanic activity at one time in the moon's history, it cannot be held responsible for crater formation in general. Consequently we must turn to some other natural agency.

## The Meteoric Theory

For a time this theory gained very considerable support, seeming to explain features which had until then appeared somewhat anomalous. To this day it has many adherents although valid objections to it are now rather numerous. The discovery of the famous Meteor Crater in Arizona gave it some support. This is a mile wide, formed largely in solid rock, and assuredly not of volcanic origin. It possesses gentle slopes on the outside, but those within are considerably steeper; its floor is well below the general surface level. There are certain similarities in profile between it and a lunar crater, the most outstanding dissimiliarity being one of size. It follows, of course, that such impact craters would not bear any relation to lines of weakness in the lunar crust. Moreover, in many cases they would obliterate older impact craters and in others score "hits" on older crater walls.

A certain amount of interesting research toward correlating meteoric impacts with lunar crater formation was carried out in 1918 by the geologist Dr. Alfred Wegener. After experimenting at some length with models made from cement dust and "plaster of Paris," he reported as follows: "A meteor, breaking up on impact, would have its fragments widely distributed. These would be spread thinnest over the crater floor but would be more concentrated on the inner rim of the ring wall. Thus there would be no main mass remaining." It is noteworthy to add that as yet, no "main mass" has ever been discovered in the Arizona Crater, although much is scattered for many miles around the rim. The "central peak" simply is undisturbed ground matter left in place though almost unquestionably crushed and deformed.

Further, according to meteor theory, "Maria" differs from large craters (or walled plains) in only two respects, size and smoothness. It is suggested that these were caused by meteors large enough to penetrate the moon's crust, thereby causing liquid magma from the interior to well up (*e.g.*, the Mare Imbrium). Around the crater rim, some areas would be only partially flooded by this molten material and there would also be remains of what are (in terms of this theory at any rate) old mountains which, though partially melted down, did not disappear completely. It was further suggested that craters with "rays" were the result of iron meteorites, the "rays" being splashes of fused metal.

Here again, at first glance, appears to be a theory with a considerable claim to validity. Closer investigation, however, reveals several substantial flaws. These may be summarized briefly as follows:

- The work of several recent and reliable observers of the moon's surface has revealed that the prevalence of summit craters is now considerably greater than was earlier thought to be the case. Nearly all of these are symmetrically placed on mountain tops, in most cases being precisely central. This unquestionably deals a heavy blow to the "hit or miss" aspect which must inevitably be an integral part of the meteoric impact theory.
- The meteoric theory, by its very nature, must demand a random distribution of craters. In fact, a considerable number of craters are arranged in chains, pairs, and clusters—far too many for this to be attributable to mere coincidence. Advocates of the meteor theory have suggested that a shower of meteors might actually fall in such a fashion as to give rise to a chain of craters, rather after the style of a "stick of bombs" dropped from an aircraft. Unfortunately their case is [negated] by the fact that each chain comprises craters of *widely differing ages.*
- It is an almost invariable rule that when one crater breaks into another, it is the *smaller* which disturbs the greater. Here again the incidence of this fact is altogether too great to be

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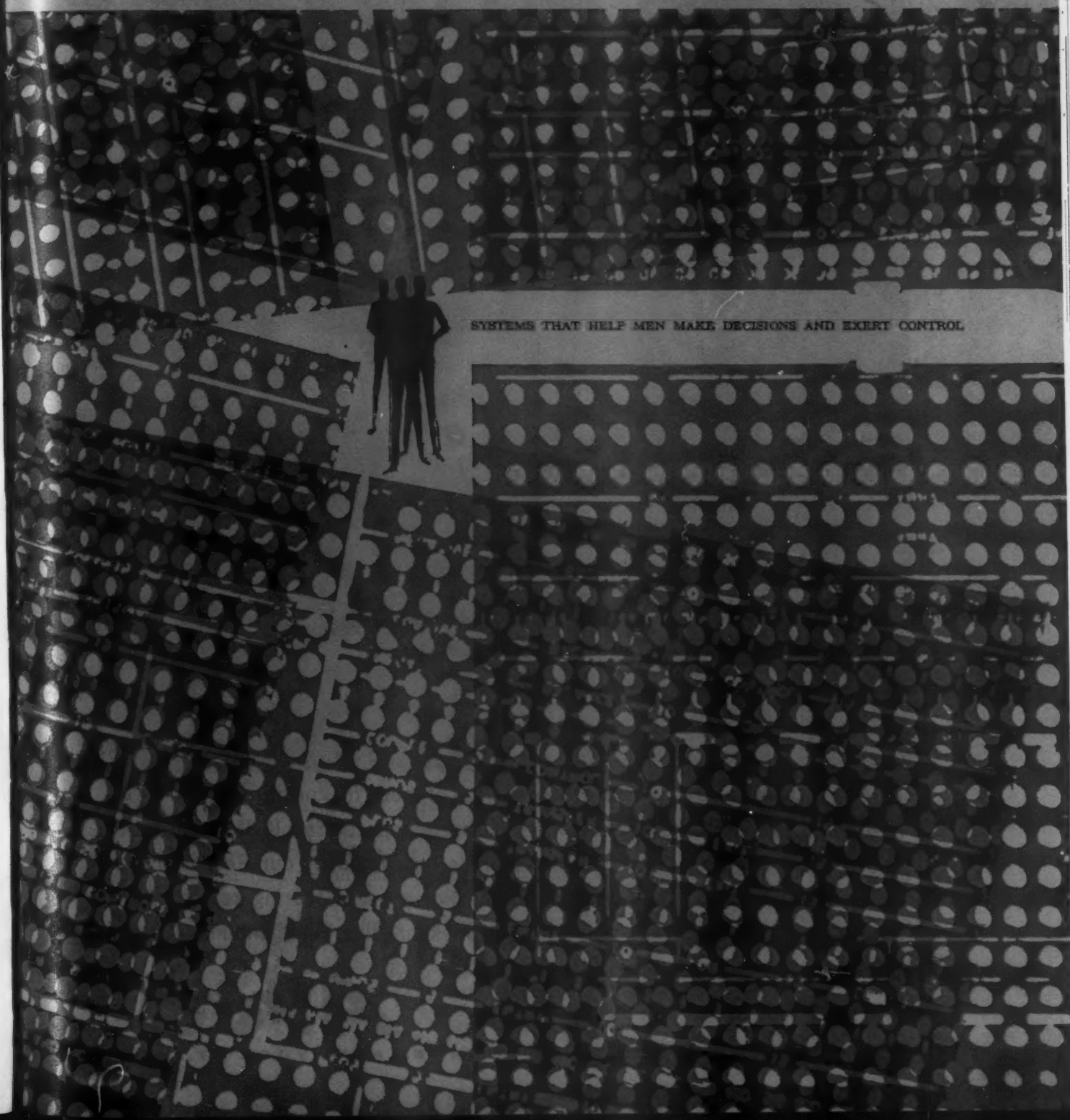

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attributed to chance. On some kind of volcanic, or at least, igneous theory, however, this is rather to be expected. As the moon aged, the amount of any such activity would naturally decline and as a general rule the older craters would be larger.

Where then do we stand? We have seen how several features of both theories show considerable validity. At the same time, objections to both are quite numerous. It seems, therefore, as though we must extend our investigations.

## The Plutonic Theory

In geology rocks formed by the action of fire or heat come under the general classification of igneous rocks. This group is subdivided into two sections known as volcanic and plutonic respectively. On the earth, volcanic rocks were formed as a result of lava cooling on the surface (basalt, obsidian, pumice, etc.). Under this second heading may also be included intrusive rocks, formed from liquid magma which has succeeded in forcing its way to the surface. Thus, the "plutonic theory" of lunar crater formation, as its name implies, bases its case on igneous material coming from beneath the moon's crust.

It postulates that in a remote age in the past the distance between earth and moon was considerably less than it is today. As a direct consequence of this, tidal effects would be expected to set up appreciable strains in the moon's crust. At weak points in it, hot magma from the interior would force its way to the surface forming a kind of feed pipe and eventually the entire surrounding area would be raised in a vast protuberance not unlike a crude form of dome or bubble. Frequently the pressure from below would be insufficient for the process to continue, whereupon the emission of hot magma would cease, although the "dome" would remain. Such a large amount of gas would be forced out through the initial vent, however, that the pressure below would fall quite suddenly. As a result the dome would abruptly collapse into the hot magma beneath and melt. In all probability this would be repeated many times, resulting in the formation of walls of little height above the surrounding terrain, but of fairly considerable height above the frequently remelted interior floor. As this floor gradually solidified, hills, terraces, and minor craters would be formed. The final stages of this strange cataclysm would lead to the formation of the central massif or peak.

In some cases it is considered likely that a final vast convulsion would result in the complete obliteration of all interior features including the central peak. Furthermore, it is axiomatic that early activity would be the most violent, resulting inevitably in larger formations. Consequently, smaller ones formed at a later period by less massive forces would frequently break into some of the larger and older craters. Since the original vents or pipes would appear along lines of weakness in the crust then, of course, it follows that the resultant craters would also follow such lines, appearing as the chains and groups of craters we see today. As far as the large plains or "maria" are concerned it seems reasonably safe to assume they were created at some later period in the moon's history, though still at an early stage in the over-all development of the satellite. They may well have been the result of several cataclysmic seismic disturbances which caused tremendous subsidences and upthrusts.

It would be foolish to pretend that this theory is without its defects and in many respects it may even appear fanciful. Nevertheless, it would seem to account reasonably satisfactorily not only for the existence of the craters, but also for their over-all distribution and their tendency to form groups and chains as well as for floor details—features which many feel today cannot readily be explained by either of the other two theories. The "plutonic" alternative may not be wholly accurate but modifications and extensions to it may well approximate rather closely to the truth. If to it is coupled the reasonable assumption that some true volcanic craters (as evidenced by rim and crest craterlets) and a few genuine meteor craters are also present, then a reasonably realistic picture of the moon's early history may well have been drawn.

The controversy will doubtless continue until the first [manned] lunar expedition.—END

*John W. MacVey, a Fellow of the Royal Astronomical and British Interplanetary Societies, lives in Scotland and is a research chemist with Imperial Chemical Industries Ltd. An amateur astronomer since 1938, he has his own observatory at home, with which he is principally engaged in lunar and variable star studies. This article is condensed, with permission, from the January, 1961 issue of* Spaceflight, *the magazine of the British Interplanetary Society.*

*New NASA Administrator, James E. Webb, right, chats with Sen. Robert S. Kerr, Democrat of Oklahoma, and Senate space committee chairman.*

★ ★ ★ ★ ★ ★ ★ ★ ★

*A Capital-seasoned administrator gets the tough top spot as chief of the civil space agency . . .*

# JAMES E. WEBB
## — *New Boss at NASA*

★ ★ ★ ★ ★ ★ ★ ★ ★

IT WILL be an odd turnabout for the new Administrator of the nation's civil space agency. Not too many years ago, as Director of the Bureau of the Budget, he was the man who often had to say no to requests for large sums of federal money. Now James Edwin Webb will be in the asking position.

The lawyer-businessman-public servant from Oklahoma and native of North Carolina, named by President Kennedy to succeed T. Keith Glennan as Administrator of the National Aeronautics and Space Administration, is a man plainly knowledgeable about the ways of Washington. A veteran of government service as Director of the Bureau of the Budget and Undersecretary of State under President Truman, the soft-spoken Mr. Webb has also served on numerous important government advisory committees studying matters ranging from education to civil defense materiel stockpiling. He was apparently tapped for the NASA post because of his administrative ability.

When he appeared before the Senate Committee on Aeronautical and Space Sciences in early February for his confirmation hearing, he briskly read a five-page statement which traced his career, including wartime service as a Marine major, from the thirties when he studied law at George Washington University in Washington and worked as a congressional secretary on Capitol Hill, and for former Governor O. Max Gardner of North Carolina in Mr. Gardner's law office.

After that early stint in the capital, in 1936 he went to Sperry Gyroscope Company in New York and by the early forties rose to a vice presidency of that corporation. He returned to Washington after World War II, and in 1946, was appointed Director of the Bureau of the Budget, where he directed the compilation of federal research activities in separate sections of the budget documents. That new approach presaged the study by Dr. John R. Steelman which in turn led to the establishment of the National Science Foundation.

From 1949-1952, Mr. Webb served as Undersecretary of State, and in the past few years has divided his time, as he put it to the Senate committee, "roughly one-third . . . to business activities and two-thirds to public-service activities."

Among the public-service activities: president and trustee of Educational Services, a nonprofit foundation directing university research to the improvement of physics teaching in secondary schools; chairman of the Municipal Manpower Commission, a foundation devoted to finding ways of attracting able men and women to municipal and local government service. In the business world, Mr. Webb is assistant to the president of Kerr-McGee Oil Industries Incorporated on a part-time salaried basis, and is a director of McDonnell Aircraft Corporation. In addition, he is a member of several university and charitable advisory boards. Married, with two children, he lives in the northwest district of Washington.

After the hearings, during which he was rapidly confirmed in a matter of minutes, he underscored to reporters that he did not consider himself a scientist, rather an administrator who planned to learn his sizable new job from the ground up, leaning for scientific counsel on the NASA staff and Dr. Hugh Dryden, Deputy Administrator of NASA. Mr. Webb hopes to work closely with the Space Council and the Messrs. Johnson and Kennedy in what he recognizes as a tough and important assignment.—END

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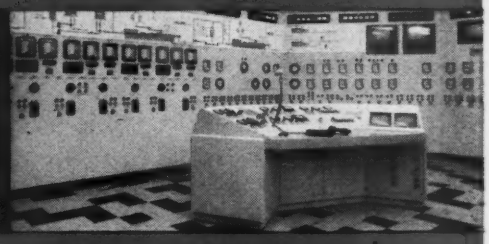

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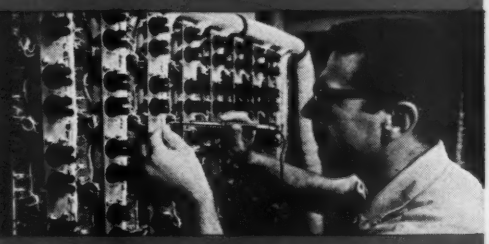

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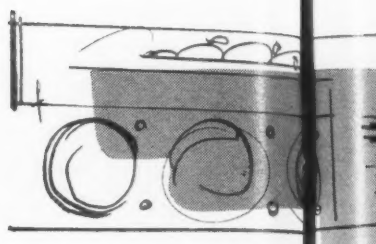


***A major revolution that could catapult teaching into the space age is brewing in laboratories across the land. It's not too early to think about . . .***

# TEACHING MACHINES — *Bane or Blessing?*

*CHARLES M. WEISENBERG*

IN MORE than a dozen research laboratories scattered across the United States, a major educational revolution is brewing, and if it succeeds the American school system will be catapulted into the space age. Teaching machines may well be the catalyst for the country's most dynamic changes in teaching philosophy, textbooks, grading systems, curriculum, school architecture, even the very routine of school life.

Although this is the most technologically sophisticated country in the world, the phrase *teaching machine* causes most Americans to recoil. It brings to mind visions of a science-fiction world, filled with robotlike people whose lives are controlled by machines. Thus, automated teaching is a concept many will oppose simply because it sounds objectionable. There may also be organized and well directed opposition from groups such as the teachers unions. In any case, automation will open new and violent debates.

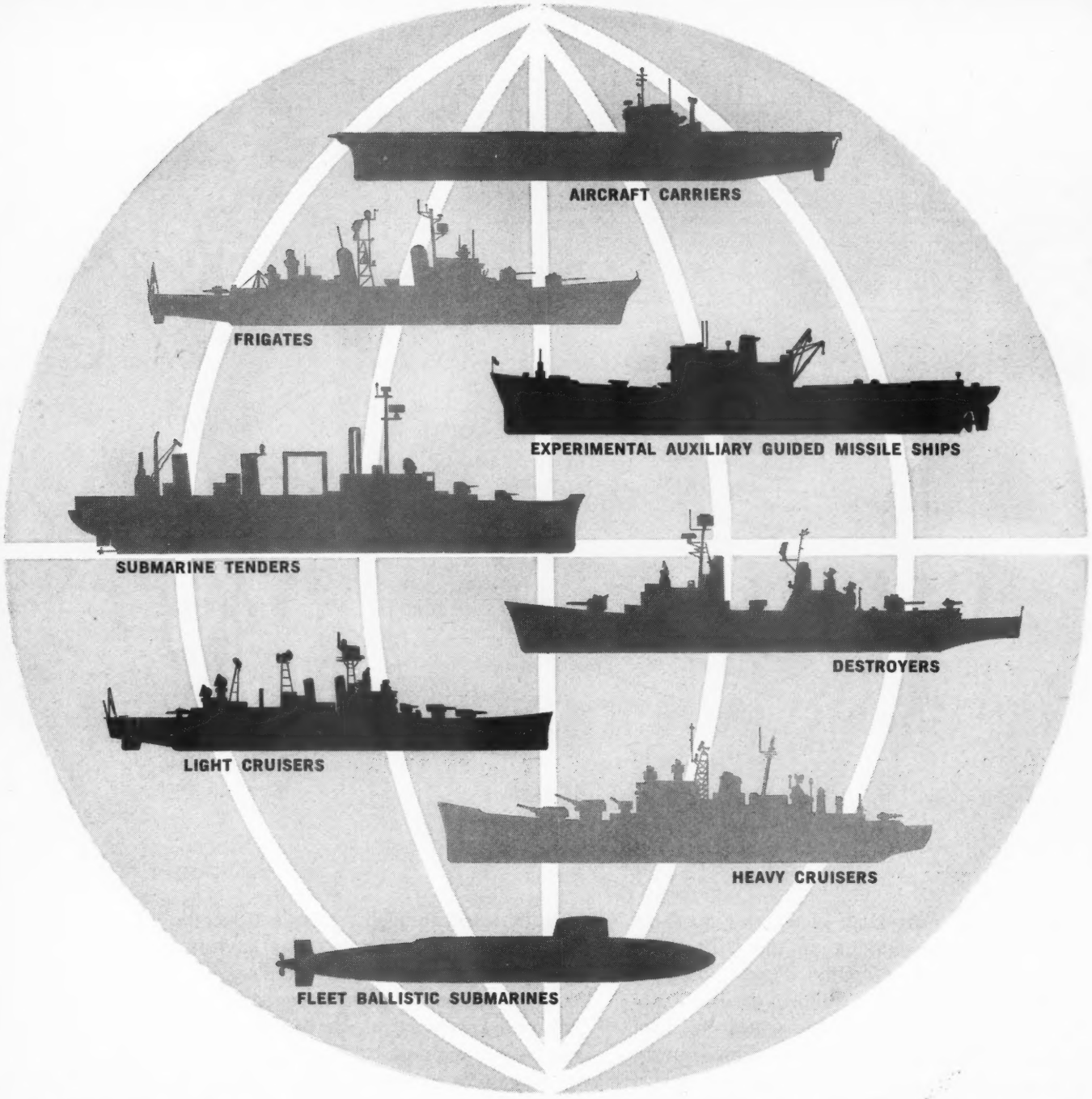
Leaders of the new revolution, for the most part, are psychologists specializing in studies of the learning process. Like many in America today, they see the need for far-reaching improvements in the educational system. These men do not talk of eliminating teachers with mechanization; rather, they speak of giving the teacher his most important aid since the printing press was put to use making textbooks.

"Although the technology of teaching has expanded and each generation of children is better taught than the last, the fact is that the ramifications of human civilization have far out-paced the art of teaching," Eugene Galanter told the National Association of Secondary School Principals earlier this year in Portland, Ore. Galanter also told the educators that "effective teaching has always frightened people" from the beginning of time, and he said that the use of teaching machines can now triple the effectiveness of our school program.

There are as many kinds of teaching machines as there are men working on them. Professor Sidney L. Pressey of Ohio State University fathered the movement in 1926. A leading exponent, Dr. F. B. Skinner, today is using his own teaching machine as a regular part of his Harvard freshman class in psychology. In New Mexico one firm is offering a "quiet, jam-proof, cheat-proof" teaching machine capable of giving instruction in seven subjects. Elsewhere, automated teaching devices can be purchased from $65 to $5,000 apiece. There has been no mass movement to buy these instruments because there is still too little known about them and their application to an educational program. To the vast majority of teachers, to board of education members, and to the public at large, teaching machines remain a mystery.

There are many approaches being followed by researchers in this field. All machines, however, are designed to do the same basic job. Machines actually *teach,* through the ancient Socratic question-and-answer principle. The student is led through a series of carefully predetermined questions presented with increasing difficulty so he will gain knowledge of the material. Basic to all machines is the need for the student to participate actively in his education by constantly responding to the instrument. Unlike a human teacher, these devices will not give instruction while the student is gazing out the window or carving initials on a desk. Another important aspect of the machines is that they give the student an immediate evaluation of every answer. A constant knowledge of results does much to reinforce correct answers and point out errors before the student assumes they are facts. Psychologist-researchers say these basic elements put into practice some of the most important "laws of learning."

To understand the operation of a teaching machine it is necessary to realize that the question-and-answer technique can be handled by multiple

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choice or by constructed response problems. For instance, a multiple-choice instrument has several buttons the student can press to indicate his answer. The questions appear on a screen or behind a window on the machine. Several possible answers are presented at the same time. Although the techniques may vary slightly, the general procedure is for a correct answer to bring up a new question. Frequently the student is given several opportunities to answer the question, since he cannot progress until a correct answer has been recorded.

A machine demanding constructed response presents the question with space for the student to mark his answer by filling in words, figures, or symbols. When the answer is written down a lever is pulled, exposing the correct answer and covering the student's answer with a transparent shield to prevent any alterations. The student has one opportunity to answer each question.

There is no general agreement on the relative merits of multiple-choice versus constructed-response questions. Some machines use a combination of the two approaches. This is one of the important areas of automated teaching that require more exploration. All teaching machines are being developed with the basic teaching philosophy that repetition is essential for effective instruction. The repetition may be a simple repeat of previous questions or a new series of questions covering the same material from a different viewpoint.

In Santa Monica, Calif., five young men are working on what promises to be the most versatile and completely automated teaching machine in the country. It can duplicate the operating procedures of all existing machines and has a unique method of its own. The heart of the machine is a computer, the kind of electronic brain responsible for successful automation in guiding space satellites as well as maintaining bookkeeping records here on earth. The computer used for this project is slightly larger than a four-drawer filing cabinet; it controls a random-access slide projector and an electric typewriter. The computer selects questions to be projected on a screen, and the student indicates his answer on the electric typewriter. The computer then evaluates the answer, gives the student his results via the typewriter, and proceeds to select the next question. Time consumed in the complete cycle is calculated in microseconds.

This experiment is being conducted at System Development Corporation, where the huge AN/FSQ-7 computer spreads out over an area comparable to two basketball courts three stories high. System Development Corporation is primarily involved with supplying training programs for Air Force crewmen in the new worldwide air defense system, and with the preparation of computer programs for the SAGE air defense network. It is a nonprofit organization.

The computer-based teaching-machine study began two years ago and is still in the formative stage. But even now the infant machine is so sophisticated that it is almost necessary to describe all other teaching instruments as primitive. The computer's electronic memory makes the machine completely responsive to the needs of individual students. That is to say, each student receives a series of questions based on his ability and knowledge, although many students may use the machine simultaneously. It would be possible to hook up a dozen question screens and answering devices to the computer and each student would still receive a different series of questions. The secret of this operation is to be found in a technique called branching.

The computer branches a student on to the secondary list when his answers indicate failure to grasp a particular concept. Should the student reveal difficulty with the most basic elements, he is again branched to an even more fundamental list. It is important to note that any time the student is on a supplemental group of questions and indicates an understanding of the material he is branched back to the primary list. The computer gives this teaching machine amazing versatility because it can adjust the sequence and nature of problems on any number of factors. It can branch following errors on a number of scattered questions, errors on a series of questions, errors on specific key questions, time taken to answer a specific question, time taken to answer a series of questions, and student self-evaluation. The machine is capable of dealing with individual differences in a way that is impossible for a teacher with a class of twenty or more students.

The System Development Corporation pilot model uses a standard computer, which means there is a great deal of equipment energy going to waste. Researcher Ralph Melaragno says specially designed computers will increase operating efficiency and offer a choice of installations. A giant computer could be built to teach a hundred or more students several subjects at the same time, or miniature computers could be designed.

The pace of automated instruction is deter-

mined by each student and his ability to answer questions. Researchers claim this as a major advantage over present classroom situations where the teacher must set a pace not too slow for the fastest and not too fast for the slowest. It is this necessity, of course, that has led to charges of mediocrity in American education, and personalized instruction is one way to eliminate the three-ring circus teachers are called upon to conduct in today's classrooms.

It would be presumptuous for anyone to claim he has solved the problem of automated teaching with many important areas of basic research untouched. Nobody, for example, has looked into the kinds of problems that might develop out of the relationship between students and machines. What will be the effect on those intangible benefits teachers insist can only be gained through constant personal contact? "Instead of oiling machines the teacher needs to spend her time oiling children, at the right spots and at the right time, and where they are at the moment," insists the editor of one education magazine.

Psychologist-researchers are still in the surface-scratching stage of this work, but some teachers already are getting ready for automation. James D. Finn, professor of education at the University of Southern California and president of the National Department of Audiovisual Instruction, says education is the one aspect of American society that has walled itself off from technological advances. He is urging audio-visual instructors to expand their horizons to include automated teaching devices so they will be ready for the future.

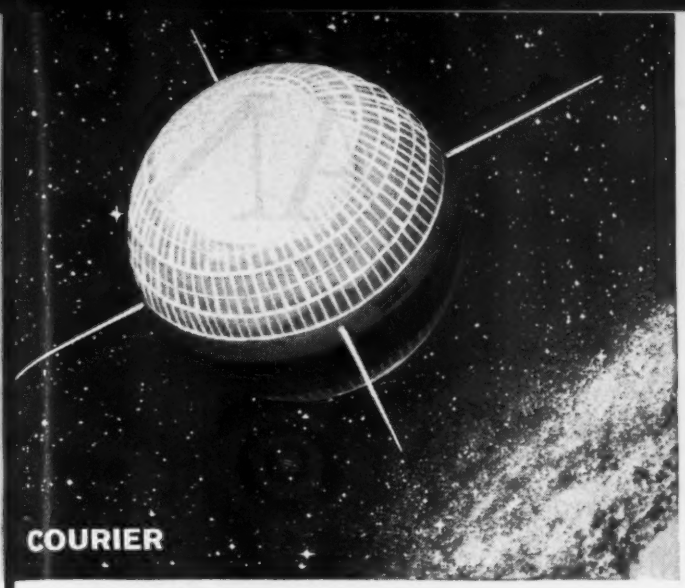
There are many so-called teaching devices on the market today and some are no more than mere educational toys. Many researchers, like Melaragno, are apprehensive about merchandisers who may delay final acceptance of automated teaching by selling pseudo-teaching machines before the instruments are fully developed. Even under the most ideal circumstances it will be difficult to introduce automation into the school system. That the selling of automation will be no simple job is evidenced in the attitude of Eddy Irwin, vice president of the American Federation of Teachers. "This is just one more method that school boards will use to cut the sacred tax rate. Developers of the machines are idealists and undoubtedly sincere in trying to aid the teaching profession, but when these machines come into the hands of the people responsible for the tax rate they will use it as a means of cutting costs," warns Irwin. He goes on to enter serious doubts that machines can really teach. Irwin says the boards have already tried to cut costs with television classes, teachers aids, a twelve-month school year, and double sessions.

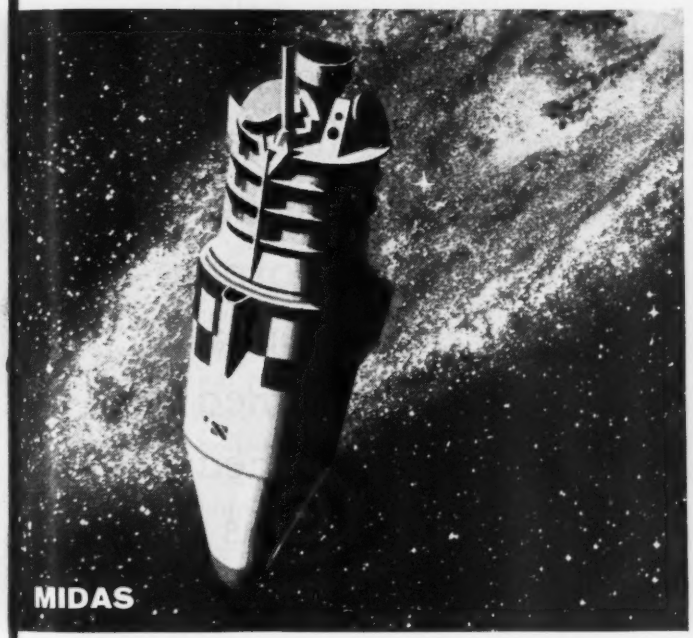
School administrators may be convinced that there has been a serious lag in bringing the benefits of American technology to the school system, but they hesitate to incur the wrath of well organized teacher and parent groups. Several unhappy experiences with educational television have made them extremely cautious in this regard. In Los Angeles, for instance, some teachers talk with pride about having held educational television down to a small experiment. Thus administrators are faced with the enormous task of integrating teaching machines without antagonizing teachers, scaring parents, or upsetting students.

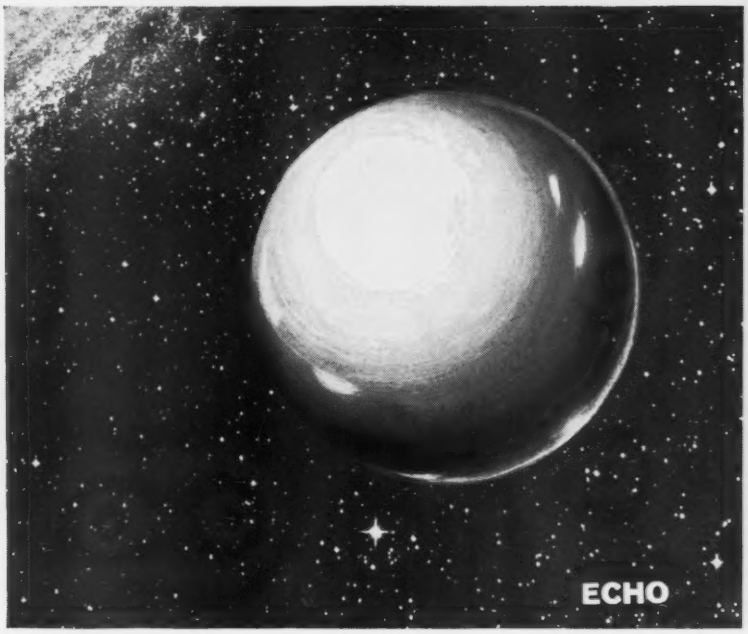
One testimonial for teaching machines comes from a New York educator who says that mathematics studies with eighth graders show that topics can be covered in half the time with teaching machines. While he does not envision wholesale displacement of human teachers, he warns that anyone capable of being replaced by a machine shouldn't be a teacher. "Teaching machines, or more correctly automated teaching, at present represents a method without a philosophy of application," he says.

Nevertheless, there seems little doubt that it is only a matter of time before automation comes to American schools. Like any major revolution it is impossible to predict the final results so early in the development. But this much is certain: Automation will require new techniques and new concepts for every aspect of our educational system. The thought of leaving comfortable and familiar teaching techniques is frightening to some, but to others it is essential, exciting, and filled with promise for the future.—END

*Charles M. Weisenberg, a former California newspaperman, is now Public Relations Director of the Los Angeles Public Library. Since Sputnik, he has written frequently on the impact of the new technology on education, and his articles have been published in several national magazines, including* Saturday Review *and* The Reporter. *This article is reprinted, with permission, from* The Commonweal, *where it appeared on January 27, 1961.*



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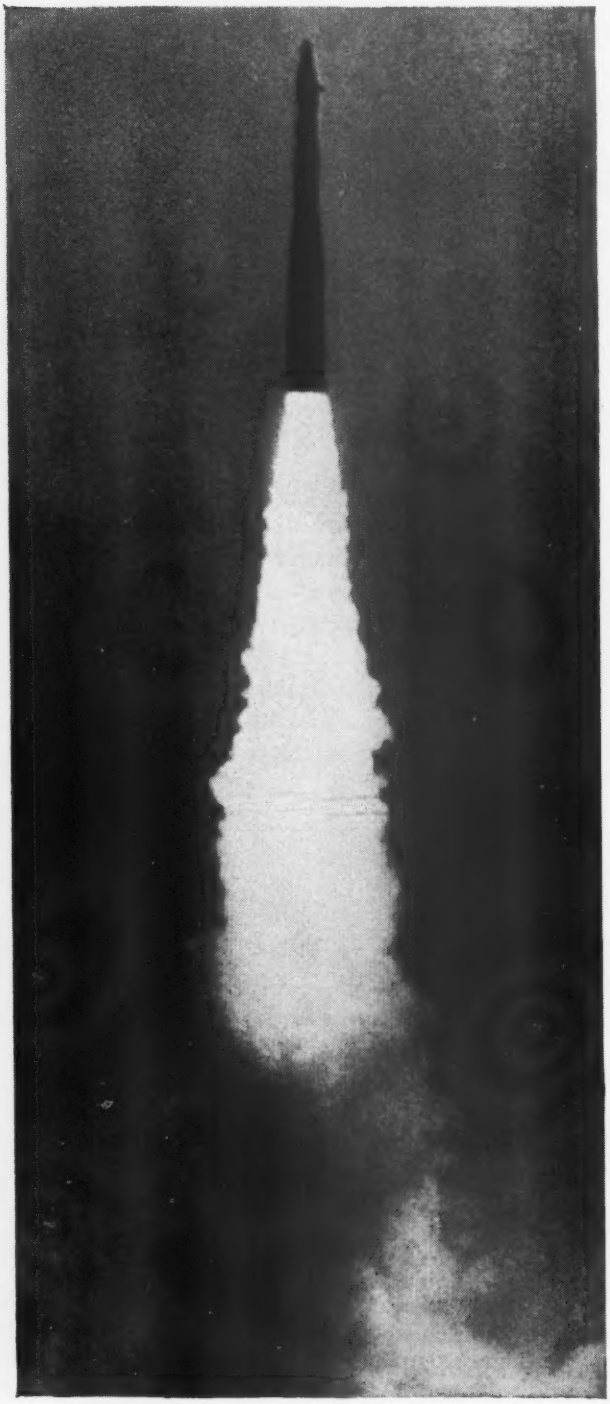

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# *Speaking of* SPACE

*WILLIAM LEAVITT*
*Associate Editor,* SPACE DIGEST

## Thoughts While Snow-Shoveling

If you happened to be snowbound in the Northeast during the great white month of February, you will appreciate the grand irony that in this, the fourth year of the space age, a few feet of snow were enough to cripple the most technologically advanced society in history. For, even as the smothered cities were digging themselves out, US missileers and space technologists were busily engaged in successful launch and recovery of Ham, the intrepid chimpanzee, after a ballistic flight that advanced the US Mercury manned orbital mission program; successful launch of the US Air Force's solid-fueled Minuteman ICBM; and successful launch of USAF's Samos II test vehicle into polar orbit to study the feasibility of significant photo-reconnaissance and mapping from space.

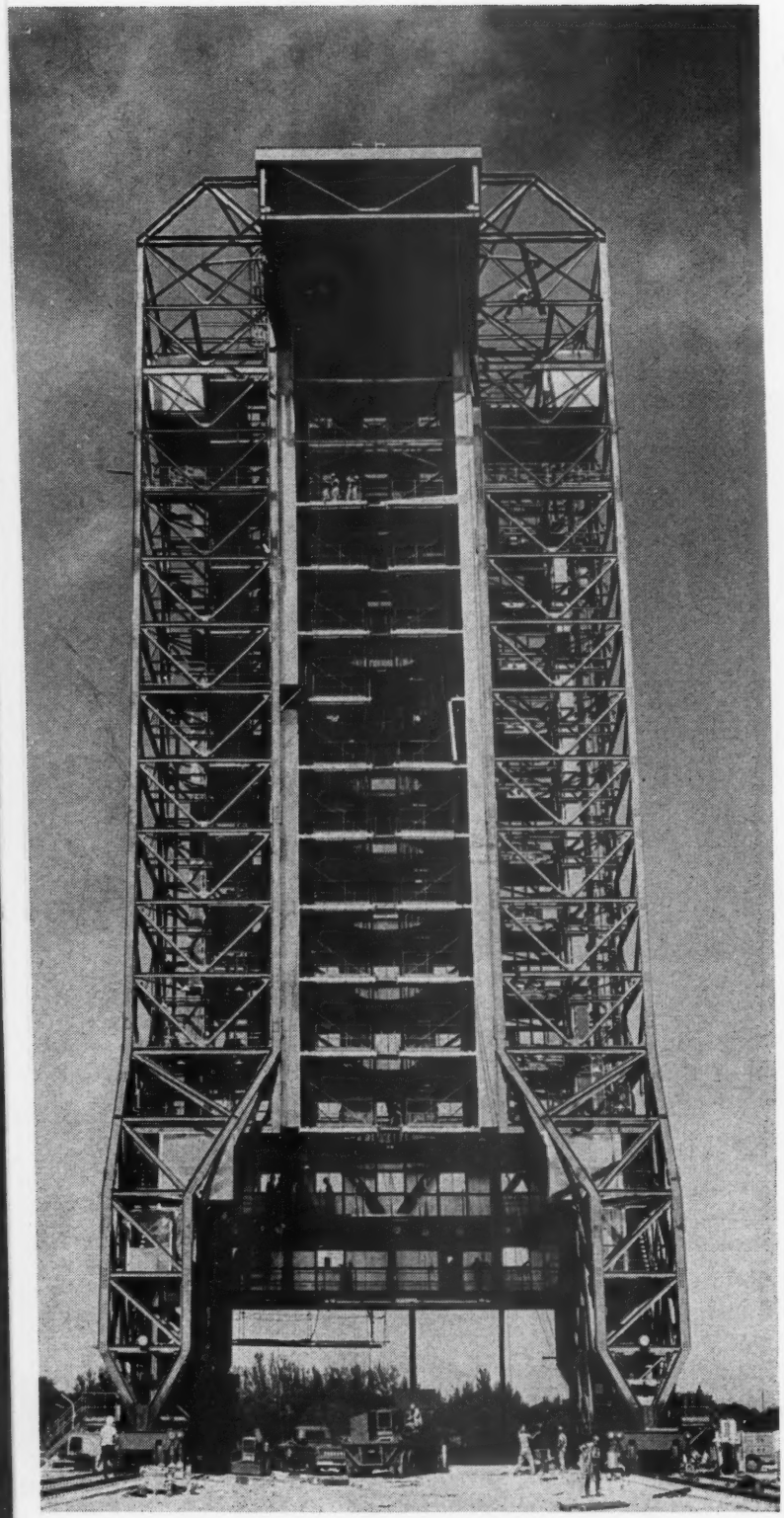
The Russians, meanwhile, were not idle in astronautics, although they, too, were doubtless coping with a traditionally cruel winter. On the heels of the triple-header US February space week, they managed to put up a seven-ton Sputnik VII, which at once set the world buzzing over whether there was a man aboard, a question unanswered at this writing, although man aboard or not, there is little doubt that a man *could* have been aboard such a huge vehicle, if the Russians wanted to have him there.

There is something at least mildly symbolic in these contrasts. To the man in the street who can't make it to his office seven miles from home because of the snow, it is difficult to consider that what to him seems the significant present is fast giving way to an uncertain future symbolized by the launchings he reads about most routinely in his daily newspaper.

In its way, of all the launchings, the Samos II test vehicle is the most symbolic of that uncertain future. For Americans, and for the free world, it is even more significant than the giant Russian vehicle. This is because, soon, for the first time, US space technology may well be ready to make a vital contribution to world peace. A contribution not just in terms of new scientific knowledge, as important as that is, but a contribution to the alleviation of the cold war itself. But this will be true only if a special brand of courage and diplomatic creativity marks the introduction of such a new capability to the world scene.

*This survival suit, developed by the Firewel Company of Buffalo, N. Y., for the Air Force Flight Test Center, Edwards AFB, Calif., shields wearer against any known chemical environment. It was developed to protect the handlers of rocket fuel.*

There is much talk of disarmament these days. And refreshingly, there is much use of the more realistic phrase, "arms control." Only the naïve and the sentimental accept the Utopian view that a spontaneous change of heart on both sides of the Iron Curtain will occur and lead to a total laying down of arms, as is so cynically proposed by Nikita Khrushchev. Nor would total disarma-



*This huge service tower, 173 feet high, for Space Launch Complex 36 at Cape Canaveral, Fla., is nearing completion. Mounted on rails, the complex will be used in launch of Atlas-Centaur vehicle, part of the NASA program to augment US booster power now lagging behind that of the USSR.*

ment necessarily lead to a more stable world situation. But that a situation could develop wherein it would be realistically advantageous for both sides to limit their war-making capability is not beyond the realm of possibility.

For good reason, we do not trust the Russians. Their actions since World War II and their continuing political offensive belie their seasonal assurances. They do not trust us, possibly because they consider our society capable of attacking them in a last-minute attempt to save ourselves from the future they plan for all the world. This, of course, is the rationale behind their unceasing efforts to back us into a position where we will decide that it is wiser for us to acquiesce to piecemeal defeat—leading to the day they can present us with an ultimatum which we could not reject, the day that from space itself they could threaten attack with impunity on us.

The Samos and Midas projects to provide reconnaissance and early warning from space could alter this potentially fatal equation, and provide the basis for a strong US diplomatic offensive in the United Nations that might shatter the carefully structured Soviet image as champion of peace and defender against the "colonial" powers.

Samos and Midas offer respectively a real possibility of warning against buildup of large-scale military preparations and alert of actual missile attack. The potential dual capability of Samos' constant photographic surveillance and Midas' alarm system against missile launches represents a great new dimension of technology to serve peace.

Therefore, it is no surprise to note Soviet grumblings—not yet official but quite audible—about Pentagon plans for "spy satellites." One may expect that as the US capability in this area increases, the Soviets will louden their cries against our efforts in this field.

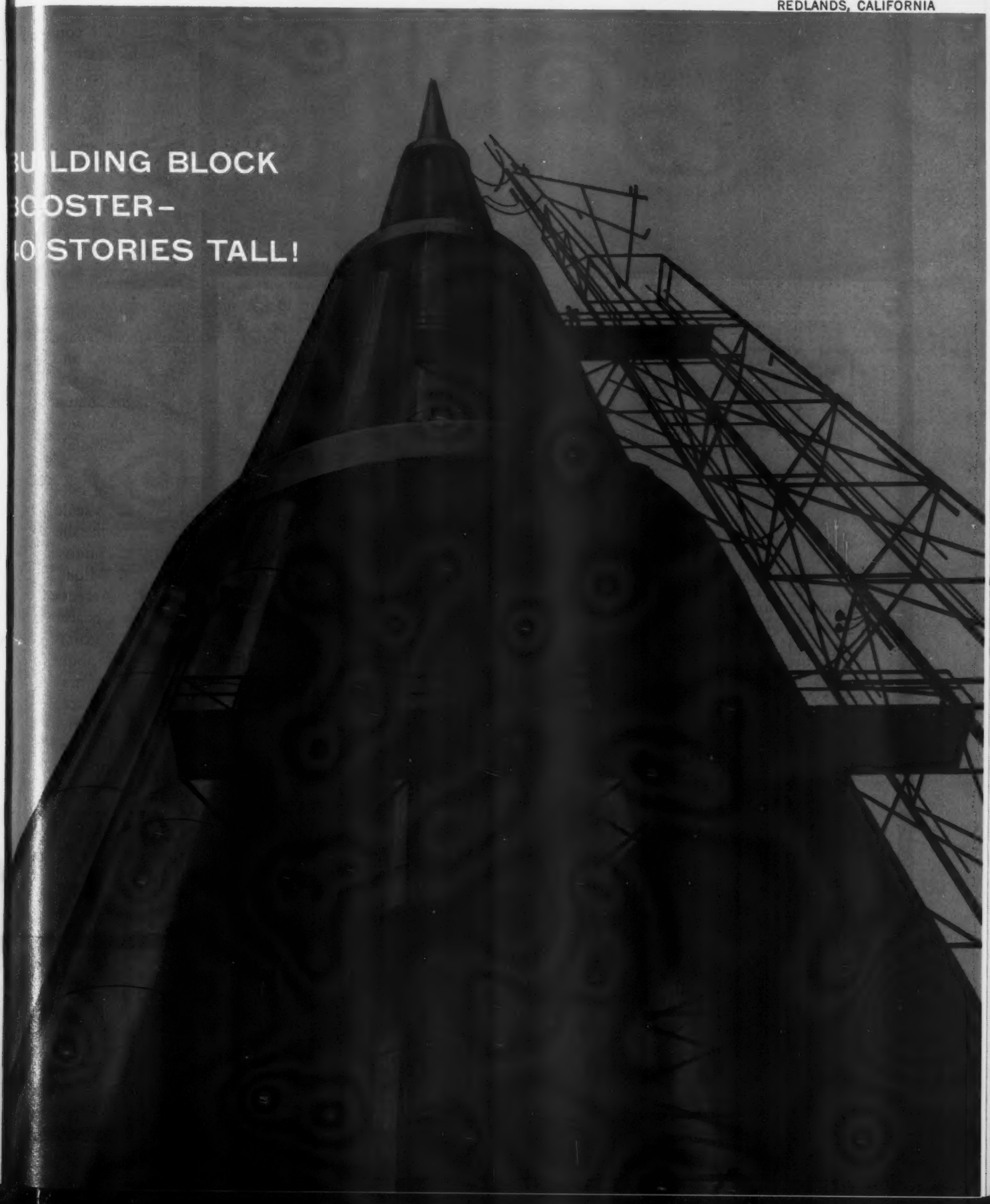
Not only from Soviet quarters will the cry come. There will be pressure against Midas-Samos from our own side of the Iron Curtain. We will be told that after the U-2 fiasco, it would be folly to proceed with spaceborne surveillance, that we are playing with fire, that such efforts are unduly "provocative."

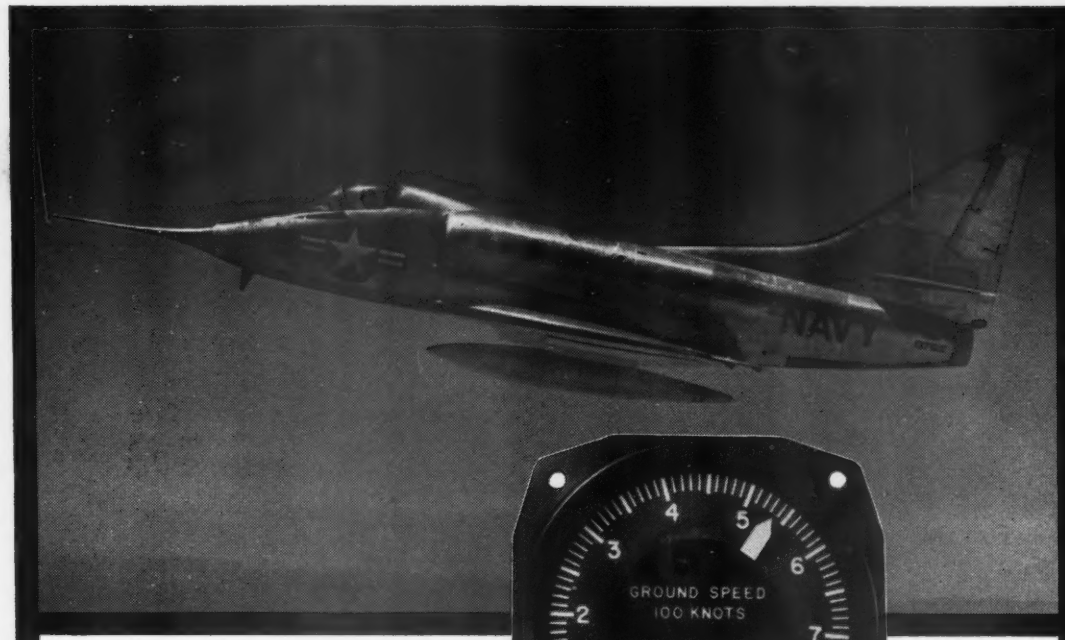
Against such pressures, the Administration may well be hard put to press forward with surveillance-from-space systems. Yet to submit to the pressures would be to rob this country and the free world of an important new deterrent tool.

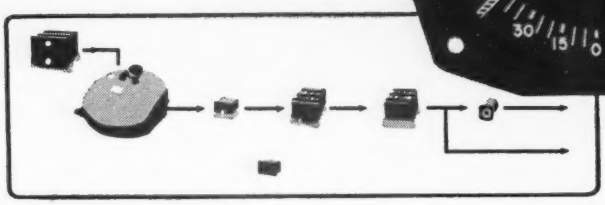
To proceed with the projects at full speed will be not without risk. The Soviets are almost psy-

**is gigantic GCR-proposed solid propellant booster** is made up of easy-to-haul segments that mply would be bolted together at launch site. It could put a 250,000-pound space station in orbit—or nd a 60,000-pound manned spacecraft to the moon. It can be developed, built, tested, assembled, intained, and operated for a small fraction of the cost of a comparable liquid system—yet it is much re reliable. It can be operational by 1967—if we start now. Smaller solid boosters—able to orbit 30,000 unds—can be available by 1964. **GRAND CENTRAL ROCKET COMPANY**

REDLANDS, CALIFORNIA







## WHY THE RYAN APN-122(V) GROUND VELOCITY INDICATOR IS THE FINEST, MOST WIDELY USED DOPPLER NAVIGATOR IN THE WORLD

Adaptable for nearly every type of aircraft, the Ryan APN-122(V) continuous wave Doppler system provides instantaneous and continuous display of ground speed and drift angle *in all weather* without reliance on ground or celestial aids. Here are some of the advantages that make this Ryan radar system the most advanced, *proven* means of aerial navigation.

- Ryan APN-122(V) is **qualified,** thoroughly **proven** in flight and **in full production.**
- Meets MIL-T-5422D and MIL-E-5400C specifications.
- Has no altitude or attitude holes.
- High accuracy (within ½%) at all altitudes from 0 to 70,000 feet, and over seas even smoother than Beaufort 1.
- No minimum altitude. Operates during take-offs, landings and turns.
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- Speed ranges: 80-1000 knots; and 120-1600 knots.
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RECONNAISSANCE • AERIAL PHOTOGRAPHY • AERIAL SURVEYS • AEROLOGY
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**AIRCRAFT ALREADY USING RYAN APN-122(V) NAVIGATOR**

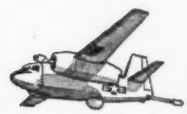
A2F W2F

R5D

P5M

P3V

A4D



S2F

A3D

P2V

WV-2E

RYAN OFFERS CHALLENGING OPPORTUNITIES TO ENGINEERS

# RYAN ELECTRONICS

DIVISION OF RYAN AERONAUTICAL COMPANY • SAN DIEGO, CALIFORNIA

chopathic about the maintenance of secrecy. They may well try to knock down US surveillance vehicles, and considering their boost capability they may well succeed.

But how much would their antisatellite victory be worth in the court of world opinion if by then all the nations had seen them in their nakedness by means of photos transmitted from space?

Midas and Samos are not U-2 revisited. It is worth recalling that most of the criticism directed against the US at the time of the U-2 affair was in terms of our not planning against the possibility of being caught and in terms of our overt admissions when we were caught.

The U-2's problems will not apply in the case of Midas and Samos. The world will know what we are about, and that both the free world *and* the Communist world—if it is sincere in desiring peaceful competition—can benefit from our effort. If, through the United Nations, we campaign strongly for acceptance of surveillance systems as a contributor to warning against aggressive military buildups, perhaps we can not only begin to reverse the Russian diplomatic tide among the uncommitted nations, but also make some real progress in putting space technology to work in the field of arms control.

During the latter days of the Eisenhower Administration, it was hoped that when the former President addressed the UN last year he would spell out some of the foregoing in clear terms. But that did not materialize, except in some vague paragraphs of the speech he made to the world assembly.

Now there is a new opportunity—not without risk, as noted—really to seize the international psychological offensive, to force the Russians to put up or shut up on the vital issues of peace or war, of arms control or uncontrollable arms.

## Slow Pace for Eurospace

Although no firm agreement has been reached, Western European powers are considering the possibilities of a joint European space program.

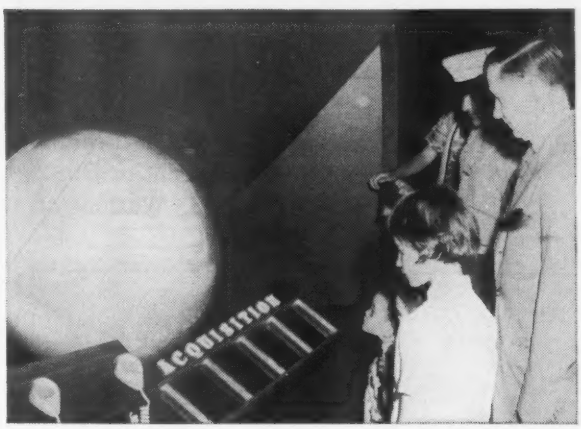
The recent meeting of the European Space Conference at Strasbourg heard a British proposal for a launch program that would place a cooperative European communications satellite system in orbit in the sixties.

The British plan calls for use of the United Kingdom's Blue Streak vehicle as first stage, with a yet-to-be-designed French second stage, and a "European" third stage. The British proposal calls for principal financing of the project by Britain, France, West Germany, and Italy, with smaller contributions by Belgium, Denmark, Austria, the Netherlands, Norway, Spain, and Switzerland. West Germany is reported to be cool to the communications project idea, although willing to participate in a space research project, which may be the most that Western Europe will be able to agree on initially.

Meanwhile, discussion continues in Britain on the question of whether Britain ought to strike out on her own in peaceful-uses-of-space projects.

## Space Capsules

Red China poses no present astronautical threat to the US, according to a statement by National Aeronautics and Space Administration's Dr.




*This is part of large walk-through display which tells the complex story of automated data acquisition to laymen—including the youngsters—in the San Francisco area. Exhibit was created by Michael Saphier Associates, Conderback Inc., and IBM.*

Wernher von Braun at a recent meeting of the National Association of Home Builders in Washington. They're too busy catching up in other technological areas to be worried about sending a man to the moon, the German-born rocket engineer believes. . . . *Sky and Telescope* magazine for February has an excellent brief article on Giordano Bruno, the sixteenth-century Italian philosopher whose concept of the universe was remarkably close to accepted present-day views. The magazine also carries an account by Patrick Moore of his visit to Soviet astronomical observatories and a discussion of Soviet plans to build the world's largest reflecting telescope, with a 236-inch mirror. No site has yet been selected

for the giant instrument. Time estimates on completion range from 1966-67 to 1970 and beyond. . . . The National Federation of Science Abstracting and Indexing Services has compiled an interesting report on Soviet methods of gathering and disseminating worldwide technical information from journals and the like. A team from NFSAIS toured the Soviet Union in late 1959 to study Soviet methods of information collection. Write to NFSAIS, R. A. Jensen, Executive Secretary, 301 East Capitol Street, Washington 3, D. C. . . . For lunar students and scholars: The excellent new *Photographic Lunar Atlas,* with a striking collection of photos taken from Mt. Wilson, Lick Observatory, Pic du Midi, McDonald, and Yerkes Observatories, and edited by the eminent lunar astronomer, Dr. Gerald Kuiper, has now been released by the University of Chicago Press. Write to University of Chicago Press, Chicago 37, Illinois, for information on price and availability. . . . A worthwhile 281-page survey of Soviet educational programs, based on information gathered by a US government mission to the USSR, is now available from the Government Printing Office at $1.25. Write to Superintendent of Documents, Government Printing Office, Washington 25, D. C. Ask for Soviet Educational Programs, and enclose check or money order for $1.25. . . . Fat men for spaceflight? In a paper, entitled "The Inner Man," Stanley M. Garn of the Fels Research Institute, Yellow Springs, Ohio, suggests—"As man goes into space, the initial premium will at first favor a high fat-free weight, coupled with superb physical conditioning. Our national self-image will precede us into orbit!" But then he adds, "Thereafter, other considerations may well reign. If we can accept a moderately plump young male with lower fat-free weight, there will be a considerable saving in payload, for his oxygen consumption, fluid output and intake, and carbon dioxide exhalation, will be less. Possibly, for a short whirl around our planet, we could let him subsist on his fat calories supplemented by a few ounces of sugar." As we study the inner, as well as the outer man, numerous directions of research suggest themselves. The range of body motions of the fat individual is constricted. He must be set farther away from the console, yet his far reach is no greater. Yet the fatter man is generally more used to sitting for long periods, and he requires less exogenous padding. His need for oral satisfaction is greater, but his energetic requirements are less. He is, moreover, better protected against certain types of penetrating radiation, a possible plus value in space, and somewhat better protected against head injuries." Mr. Garn's paper was presented at a recent American Rocket Society Symposium on the Anatomy of Manned Space Operations, held at Dayton, Ohio. . . . "Macro Life" is the subject of a remarkable monograph by General Electric's Dr. Dandridge Cole, a space scientist who spends much of his spare time contemplating the impact on humanity of the new technology. In his monograph, entitled "Social and Political Implications of the Ultimate Human Society," Dr. Cole suggests that overpopulation, the bomb, etc., may force mankind to create artificial planets on which large human colonies would live and move about in space and in which the need for discipline to assure survival would negate many of our traditional individual freedoms. These colonies, he wrote, might be so "well organized and integrated, as to resemble a new superlife form . . . Macro Life." Information on availability of Dr. Cole's monograph can be obtained from Mr. J. C. Hoffman, Manager-Product Information, Missile and Space Vehicle Department, General Electric Company, 3198 Chestnut Street, Philadelphia 4, Pa.—END

$\partial v/\partial w=0$

Advanced programs now in progress at Martin include: vehicle stage weight optimization. The professional mind which is seeking the freedom to inquire will find unusual stimulation, association, and recognition. To participate, write to N. M. Pagan, Director of Technical & Scientific Staffing, (Dept.Y-1), The Martin Company, P.O. Box 179, Denver 1, Colorado.

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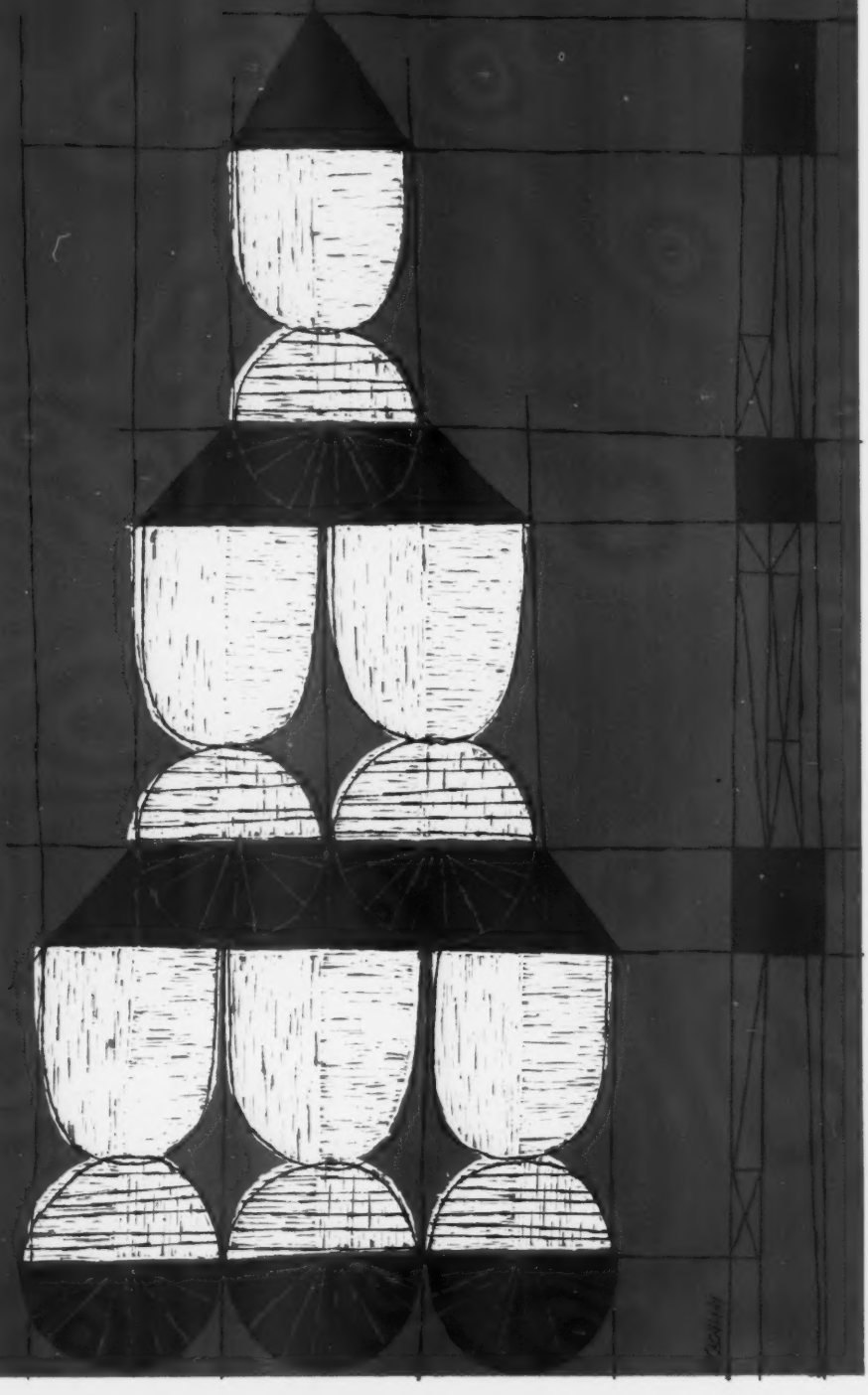
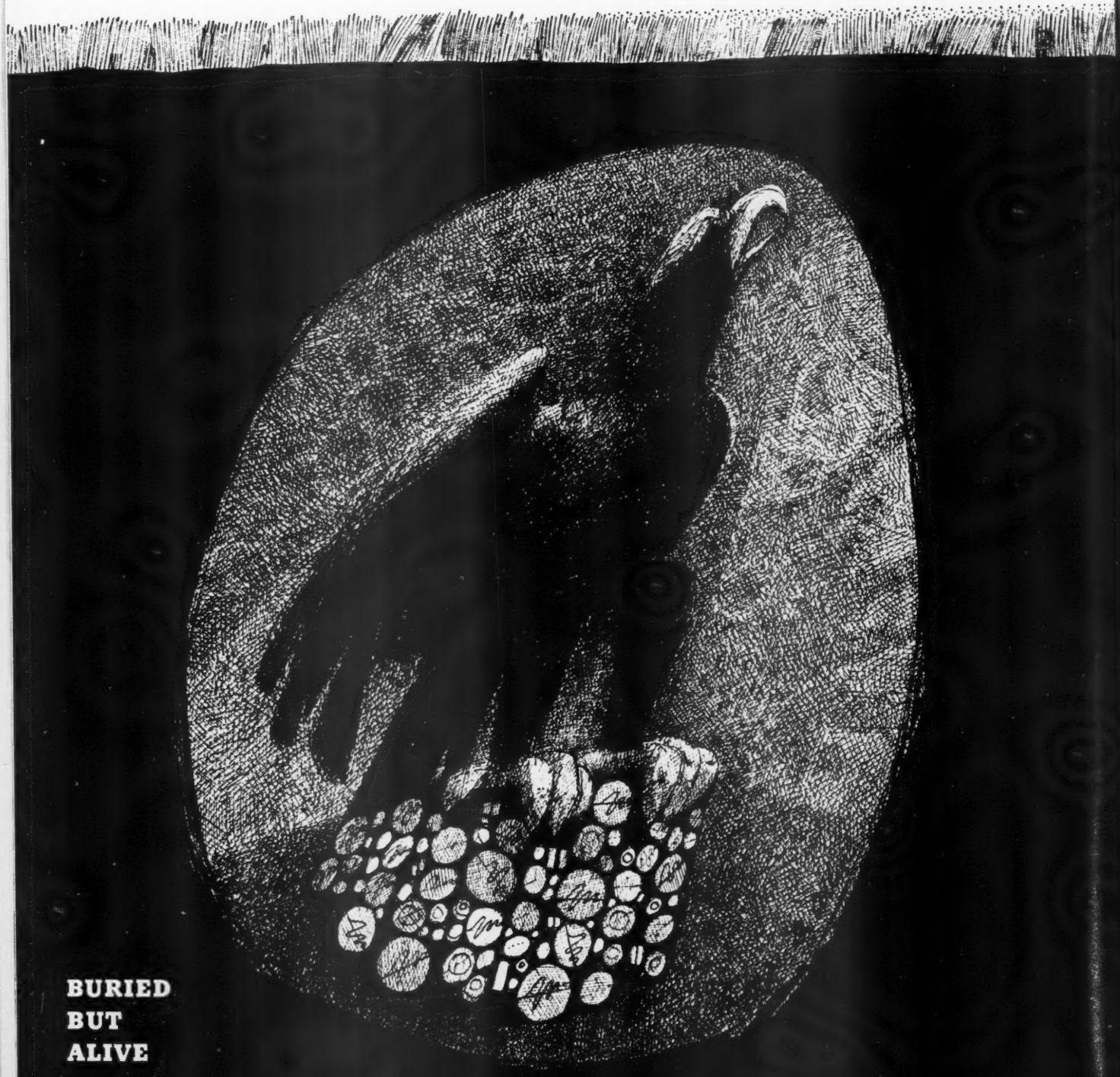




**BURIED BUT ALIVE**

Hidden in the earth, the Air Force Minuteman missile must remain ever ready. Though untended for weeks, months, even years, each of its thousands of components must function perfectly together if the button is pushed. This is the new order of reliability being fulfilled by Autonetics — designer of the Minuteman's critical guidance and control system.

Electromechanical Systems by **Autonetics** Division of North American Aviation

AIR FORCE
MARCH 1961

**A new supersonic jet trainer, the Northrop T-38 Talon, has been undergoing extensive testing before entering service with USAF. The plane has drawn praise from pilots, mechanics, engineers . . .**

**Northrop's T-38 Talon**

# *This Trainer Can GO, GO, GO*

**Ed Mack Miller**

FROM sunbaked Edwards AFB in California's Mojave Desert to the snowy winterscape of Malmstrom AFB, Mont., to Eglin AFB on Florida's Gulf Coast, Air Force test pilots have in recent months been getting to know a new supersonic jet that should one day become a familiar piece of hardware at USAF bases here and abroad.

The plane is the supersonic T-38 Talon trainer. Fifteen of the Northrop-produced aircraft are currently in operation in the far-ranging and intensive test program. The total present order includes 144 planes, with further orders expected to follow. Service planning is that the T-38, designed for training in supersonic and high-altitude flight, formation flying, acrobatics, multijet-engine operations, and night or instrument cross-country flying, will ultimately supplant the Lockheed T-33 Tee Bird jet trainer. The plane's high performance and versatility may also suit it to a number of other missions.

Through the test period, the plane has drawn praise from pilots, mechanics, and engineers. They have noted its simple maintenance, classic lines, impressive speed, range (1,150 miles), ceiling (60,000 feet). Among its important features as a trainer are runway-level ejection capability and excellent back-seat visibility for the instructor.

The only supersonic trainer adopted by a major air force and included in its inventory, the T-38 is forty-four feet long; twelve feet, ten inches high. Wingspan is twenty-five feet, three inches. Power plant is two lightweight, high-thrust General Electric J85-5 afterburning engines. Performance is comparable to combat aircraft weighing twice as much as T-38 takeoff weight of 11,500 pounds. The T-38 is capable of single-engine takeoff, go-around, and landing at maximum weight with gear and flaps down. Each engine weighs 525 pounds, delivers a maximum of 3,850 pounds of

*(Continued on following page)*

**Air Force test pilot Capt. Swart Nelson, high-time pilot in T-38, describes the plane's flight characteristics to writer Ed Mack Miller in interview at Edwards AFB, Calif.**

## T-38 TALON

thrust, and has a thrust-to-weight ratio of 7.33 to 1.

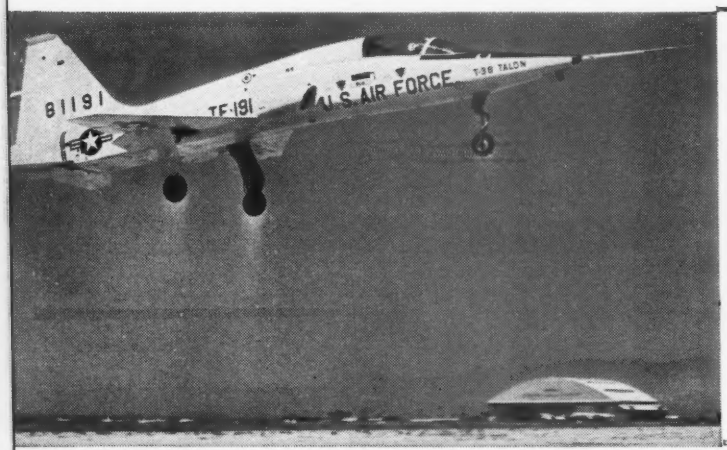
So far the T-38 has been powered by the "YJ" engine, which is rated at about 2,000 fewer pounds of thrust than the J85 engine which will power the plane later on. Best cruise with the "YJ" is Mach .86. Both speed and range will increase considerably with the "J" engine. Speed capability will be Mach 1.2 and mission endurance time better than two hours. Best afterburner climb speed of the aircraft is Mach .92. The afterburner can be used for more than twenty minutes.

attention was devoted to avoiding "built-in accidents" that might result from accident-prone electrical, hydraulic, and fuel systems.

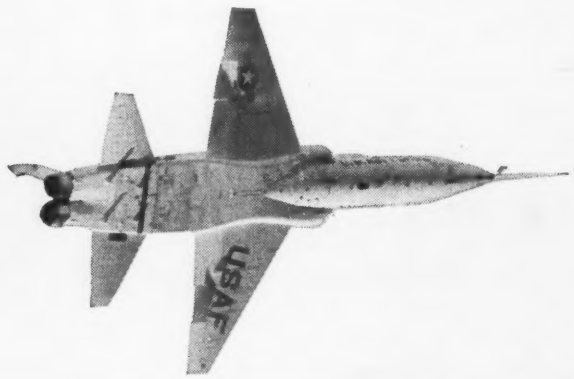
The T-38's rear seat was placed ten inches higher than the front. The instructor, as one test pilot put it, "will have so much visibility that he will feel naked." The cockpit was put together with simplicity in mind. Everything is in front of the pilot and easily reached with either hand.

Fuselage lines on the Talon are characterized by "coke-bottle" curvature in line with the area-rule theory. Wings are placed in the rear section of the fuselage just aft of the engine air scoops. The swept leading-edge wing, with low-drag characteristics, is cambered at the front to prevent tip stall. The cambered nose of the fuselage, which gives the T-38 a distinctive "anteater" or "porpoise" look, allows excellent visibility while still providing low drag. The structural load limit factor of the airplane is better than seven Gs.

The wing is designed to let the plane transition to supersonic speeds without "tuck" or "pitch." The T-38




**Talon leaves ground in test flight at Edwards. Extensive test program has been conducted at several bases.**




**Underbelly view shows T-38 design features including the contoured fuselage, flat afterbody, split between engines.**

The T-38 is a high-sink-rate aircraft. Power must be used throughout the normal landing approach, which makes it an appropriate trainer for supersonic aircraft such as the B-58, Century-series fighters, and such foreign-built high-performance craft as France's Dassault Mirage III jet fighter.

Three prime requirements were taken into consideration in design of the T-38: performance capability similar to supersonic combat aircraft; flying qualities consistent with safety requirements for trainer aircraft; and economy of maintenance and operation.

Safety and maintenance factors designed into the T-38 are a result of comprehensive study by USAF and Northrop. An effort was made to identify the frequency of failures in jet trainers, where they took place, and where most man-hours were put in in trouble-shooting and maintenance. The components that seemed to be the weakest were made easiest to get at for repair. Emphasis has been on making black boxes readily accessible for maintenance. Considerable

uses conventional ailerons and rudder. All surfaces are hydraulically powered. The all-movable horizontal stabilizer is of aluminum-alloy honeycomb with a steel spar. The vertical stabilizer is a semimonocoque, one-spar structure.

The designers believe the T-38's fuel system to be almost goof-proof. The cockpit fuel panel has only three switches—two "supply," one "cross-feed." Each engine normally receives fuel from its own fuel tanks. However, a cross-feed connection permits either engine to receive fuel from the other supply when necessary. Fuel is carried aft of the cockpits and is normally pumped by electrically powered boost pumps. Gravity feed will continue to furnish fuel at altitudes above 30,000 feet. Each system has 300 gallons for a total of 3,880 pounds of fuel. When fuel is down to 300 pounds in either tank, the pilot gets an indicator light. Test pilots say it's no sweat to go around even when down to 300 pounds.

Electrical power for the T-38 is supplied by two independent AC systems and a DC system that ob-

ains power through two transformer-rectifiers in the AC system. During normal operation, each generator carries half the load. If one fails, uninterrupted performance is maintained by automatic switchover of affected loads to the other generator. A small twenty-four-volt battery is also provided for emergency air-starts, stand-by instrument-panel lighting, and ground starts where no auxiliary power unit is available.

The T-38 also has two hydraulic systems, identical in operation but differing in the units they supply. Each system provides half the power required by the flight controls. The primary "utility" system also supplies all power needed by the landing gear, the nose-wheel-steering system, the stability-augmenter, and the speed brakes. Flaps are electrically driven. If either system fails, the other will automatically provide adequate flight control power. Even when flamed-out and windmilling, the engines should generate enough hydraulic power to maintain flight control for glide and landing. Normal windmill speed is twenty-two percent.

The T-38's windshield is hinged so that it can be swung up out of the way for facility of cockpit maintenance. A pilot bonus: no scratches on the glass. An engine can be changed on the T-38 in about twenty minutes. A complete double-engine change should take about two hours.

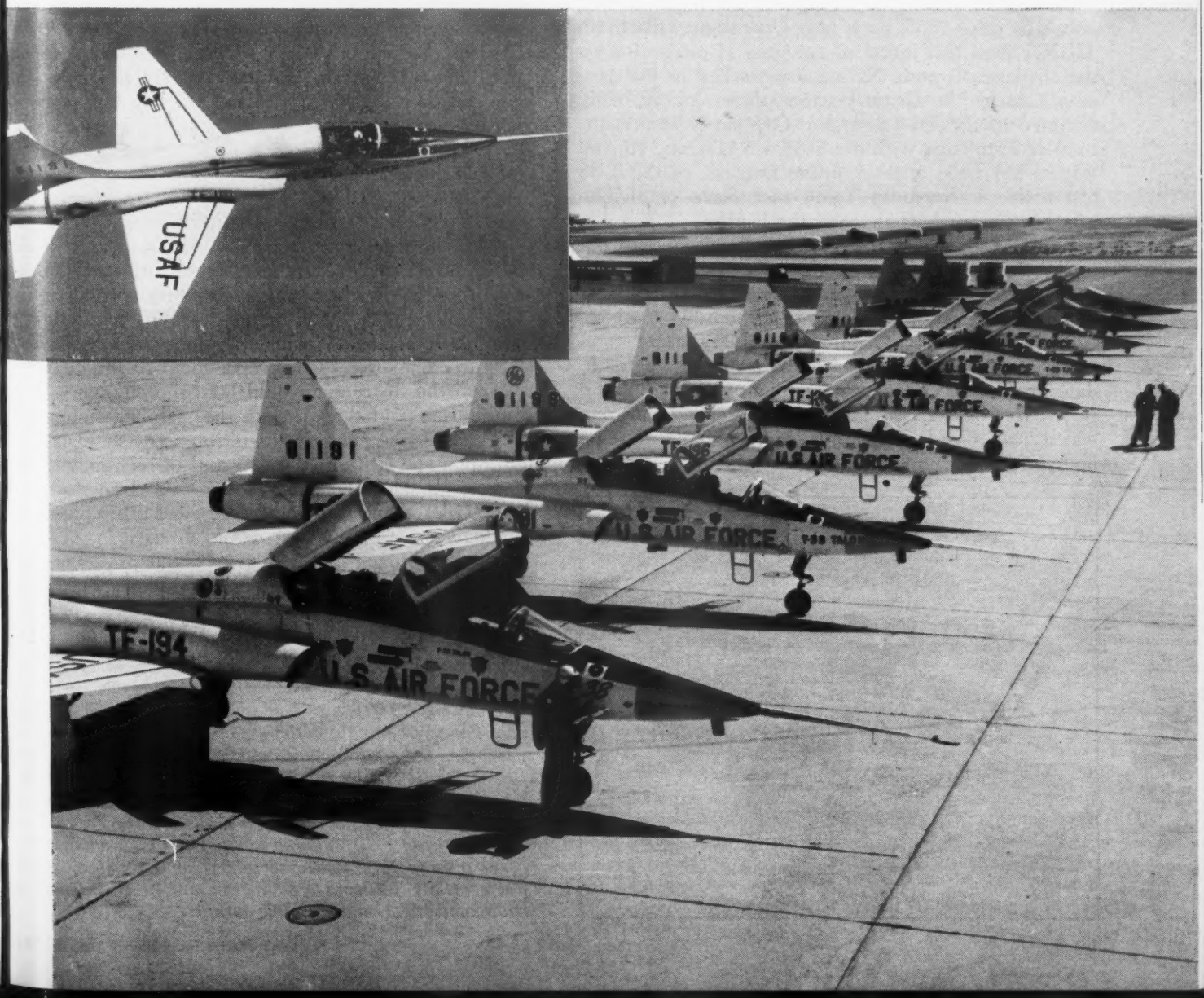
Engine-driven accessories are mounted in the airframe—not the engine—to provide maximum accessibility. Below and forward of each engine is an integrated power package consisting of a two-speed, automatic-shifting gear box, an AC generator, and a hydraulic pump. The engine can be removed from this power package almost like unscrewing a light bulb or pulling the cork from a bottle, or the power package can be removed as a unit through a forward access door without removing the engine. Removal or installation of engines is facilitated by a built-in overhead track and roller arrangement in the aircraft engine base itself.

One or two men are needed to handle the uni-

(*Continued on following page*)

**Instructor, student sit in tandem in T-38 cockpit, with instructor behind and ten inches higher than the student.**

**Flight line of T-38s at Edwards. Supersonic, twin-engine Talons will join the Air Training Command in numbers.**



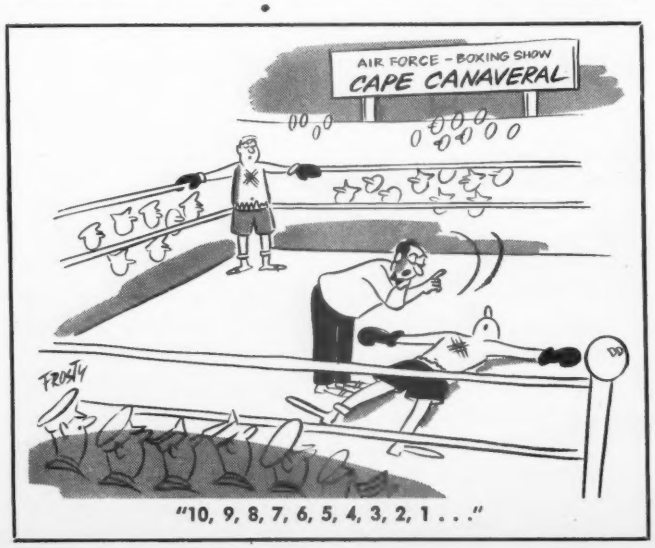
versal-lift trailer and several tubular steel adapters that mount on the trailer for support of the engine, after-fuselage, wing, or gear-box. Each adapter can be used for removal and installation of a component, for maintenance, inspection, transportation, and storage. The engine adapter can even be used in a test cell as an engine run-up stand.

From a pilot's standpoint, accessibility of cockpit controls is an outstanding feature; no controls are aft of the pilot's elbows. Greenhouse visibility has been obtained in both cockpits, which have individual jettisoning canopies. There is also a plastic chauffeur's divider panel between cockpits, so that if the student pilot in the front seat ejects, the pilot in the rear seat is protected from wind blast. The aircraft has all-white instrument panel lighting, with annunciator panel and master warning lights to alert the pilot to malfunctions. The plane will be fully instrumented with the same general panel as the latest Century-series fighters, with ILS-VOR and TACAN, and the new horizontal situation and latitude display indicators used in the F-105 and F-106.

High-time pilot on the plane thus far is Air Force Capt. Swart H. Nelson. A native of Phoenix who's been an engineering test pilot for the Air Force at Edwards since 1955, he is now Operations Officer for ARDC's joint test force for category II evaluation on the airplane. Captain Nelson has worked in test programs on all the Century-series planes before being assigned to the T-38 program. Captain Nelson is extremely impressed with the T-38. USAF Capt. Russell Rogers has been another prime member of the T-38 test team. A Northrop Talon task force of civilian pilots has carried its share of the load.

In all, more than 100 pilots have been checked out in the T-38. The plane has been flown in formation acrobatics as well as the full run of individual tests under widely varying climatic conditions.

The Air Training Command, primary using command for the T-38, has participated in test work to date. It has also engaged in training of mechanics and pilots. By the start of the year, the testing program was a little ahead of schedule. Most of the remaining hours of test time were scheduled to be used checking out Air Training Command people and setting up the ATC program. The category III program, starting at the ATC Instructor School at Randolph AFB, Tex., this month, will run for a year. A group of twenty-five students of Randolph's class 62F will be the first students trained in the plane about a year from now. Other ATC bases currently scheduled to get T-38s for basic training are Moody, Ga.; Craig, Ala.; Williams, Ariz.; Vance, Okla.; Reese, Tex.; and Webb, Tex.



"10, 9, 8, 7, 6, 5, 4, 3, 2, 1 . . ."

The student flying officer will get about 150 hours in the Cessna T-37 primary jet trainer, and something less than that in the T-38. The plane might also be used in more advanced training for Air Force pilots in interception, fighter tactics, and varied jet technique.

The Air Force initially ordered three, then six, then thirteen, then fifteen, and then 144 T-38s. The total order may come to approximately 750 for training alone. There are, in addition, other uses that may suggest themselves. SAC is understood to be considering use of the T-38 for proficiency flying training by combat crews. With fast new bombers expensive to fly, their crews might conceivably "stay in practice" at a much smaller cost in the T-38. The T-38, persons close to its development point out, could be used for spotting and reconnaissance, low-level interdiction, or as a genuine interceptor aircraft. A single-seat fighter version, the N-156F Freedom Fighter, was rolled out in mid-1959. The US Navy has been considering a version of the T-38 as an aircraft carrier trainer. A number of our overseas allies have also been taking a long look at the T-38.

As set up in the preliminary syllabus, the first mission for a student in the T-38 would be an afterburner takeoff and an afterburner climb to 36,000 feet. This would take about three and one-half minutes. It would be followed by practice 180-degree turns and an acceleration to the supersonic state, with several supersonic rolls and a "wind-up (descending and rolling) turn" with increasing forces up to four Gs supersonically. These maneuvers would take about six minutes.

Then the instructor would take the engines out of afterburner and demonstrate the stability augmenter at Mach .9—the most sensitive trim area—showing longitudinal and latitudinal pulses and correction with the damper on and off. Then they would drop down to 20,000 feet, doing lazy-eights, rolls, and other precision maneuvers. At 20,000 they would do a clean stall and a power-approach stall with gears and flaps down, then clean up the airplane and do several loops. Returning to the field, they would then shoot three or four landings. The entire flight would take about one hour. —END

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*The author, Ed Mack Miller, is an aviator-writer who has contributed frequently to these pages. Readers will recall in particular his word-pictures of Vandenberg AFB and the USAF School of Aviation Medicine, Brooks AFB, Tex., his lengthy report on the Air Force Academy at the time its first class graduated in 1959, and his hard-hitting, definitive defense of the B-70 Valkyrie bomber program when it became a temporary victim of government fiscal measures last year. Mr. Miller is a Denverite, an Air Guardsman, a commercial pilot, and a prolific author.*

# the Ready Room

RESERVE AND AIR GUARD NEWS

## Guard, Reserve Councils Meet

AFA's **Air National Guard Council** and **Air Force Reserve Council** each held its first meeting of the year on February 3 at the Mayflower Hotel, Washington. Each proved itself an all-weather organization, meeting with almost perfect attendance despite a raging snowstorm. This was also the day of the **Association's Fifteenth Anniversary Dinner** at the Mayflower, as well as a **Board of Directors' Meeting.**

Both Councils asked that the **Air Force Association** support action to effect **equalization of per diem** for nonactive-duty **Air Reservists** and **Guardsmen.** The Councils also asked AFA support for repeal of all dual compensation laws in order to provide unanimous equity for retired **Regular** and **Reserve personnel.**

Both Councils expressed violent opposition to a proposed DoD plan **for recoupment of lump sum readjustment payments** for active-duty Reservists relieved from such duty involuntarily. While supporting readjustment payments, the Councils were opposed to Air Reservists and Air Guardsmen having to **repay this readjustment payment** beginning with their retirements at age sixty. At the same time, the Air Reserve Council requested AFA's **support of the proposed retention contracts** for active-duty Reservists and Guardsmen.

**First enlisted members ever appointed to Air Reserve, Air Guard Councils of AFA talk with Brig. Gen. Howard Markey, AFA Board Chairman, during Council meetings in February. Left to right, SMSgt. John A. Petras, New Jersey Guardsman; General Markey, past AFA President; and Air Reservist Francis E. Nowicki of Pennsylvania.**

While the Air Reserve Council elected to take no stated position, at this time, on the subject of **variable length of basic training** for basic airmen going into Reserve Forces components, the Air Guard Council supported a proposal that **variable length of basic training would greatly enhance** the Reserve Forces program. The proposal would limit airmen in the lower skills to less than the now-required **six months' training.** Money saved from limitation could then be used in lengthening the training period for airmen required to fill higher-skilled slots.

The Reserve Council asked that the Air Force clearly **identify maintenance and operations funds** for the Air Reserve. The Council asked AFA to **reaffirm the position it took before the Congress** last year with respect to this matter.

The Guard Council requested that the **paid drill ceiling, now levied on the Air National Guard,** be lifted in order that Guard units might recruit up to the Unit Manning Document (UMD) authorizations. The Guard Council also asked that AFA **support utilization of organic Air National Guard airlift** for Guard personnel and equipment requiring airlift as a part of their training.

The Reserve Council requested that the Air Force **evaluate all current regulations pertaining to the Reserve Forces program** with a view to eliminating or revising these regulations which now are apparently in conflict with the new Air Reserve management concept—particularly the support and recovery program.

The Reserve Council also asked that the Air Force **consider the Air Reserve troop carrier forces in a greater perspective** and possibly assign new roles and missions to these units, and utilize a reservoir of airlift that now is working below its present capability.

The Guard Council requested that AFA afford both the Guard and Reserve Councils an **opportunity to examine and make recommendations on any proposed legislation or plan** pertaining to the reorganization of Department of Defense, prior to any official AFA position.

Both Councils appointed subcommittees to study possible future roles and missions of the Reserve components, together with problems affecting Reserve Forces programs. The Guard Council appointed a **Ground Support Tactical Fighter subcommittee, a Missiles Boosters' Recovery subcommittee** and a **Space Surveillance subcommittee.**

The Reserve Council appointed a **Troop Carrier unit subcommittee,** and a **Support and Recovery Group subcommittee.**

The reports and the recommendations of both Councils were presented to and approved by **AFA's Board of Directors** on February 4. Chairing the Air Guard Council meeting was **Brig. Gen. Frank A. Bailey. Col. James H. McPartlin** chaired the Air Reserve Council meeting.

## All to the Good

Both the **Air National Guard** and **CONAC** made substantial **gains in flying safety** during calendar year 1960, **matching or bettering the gains recorded Air Force-wide.** Air Force Reserve figures are included in the CONAC total.

The USAF rate of accidents per 100,000 flying hours **decreased from 8.2** in 1959 to **5.7 in 1960,** for a net **improvement of thirty percent.** In comparison, CONAC achieved an enviable **2.4 rate in 1960,** compared with **3.4 in 1959,** also a thirty percent improvement. The Air National Guard's 1960 rate **dropped to 9.36** as compared with **14.34 in 1959,** a net **improvement of thirty-five percent.**

These are **preliminary figures,** based in part on estimates of December flying hours.

## Ten Thousand Minus One

A **new Air Force Reserve Squadron** manned by some of the biggest "names" in the country has been formed on **Capitol Hill in Washington.** It's the **9999th AFRes Squadron,** made up entirely of Air Force Reservists who are **members of Congress or of congressional staffs.**

The squadron is unique, too, in being **commanded by**

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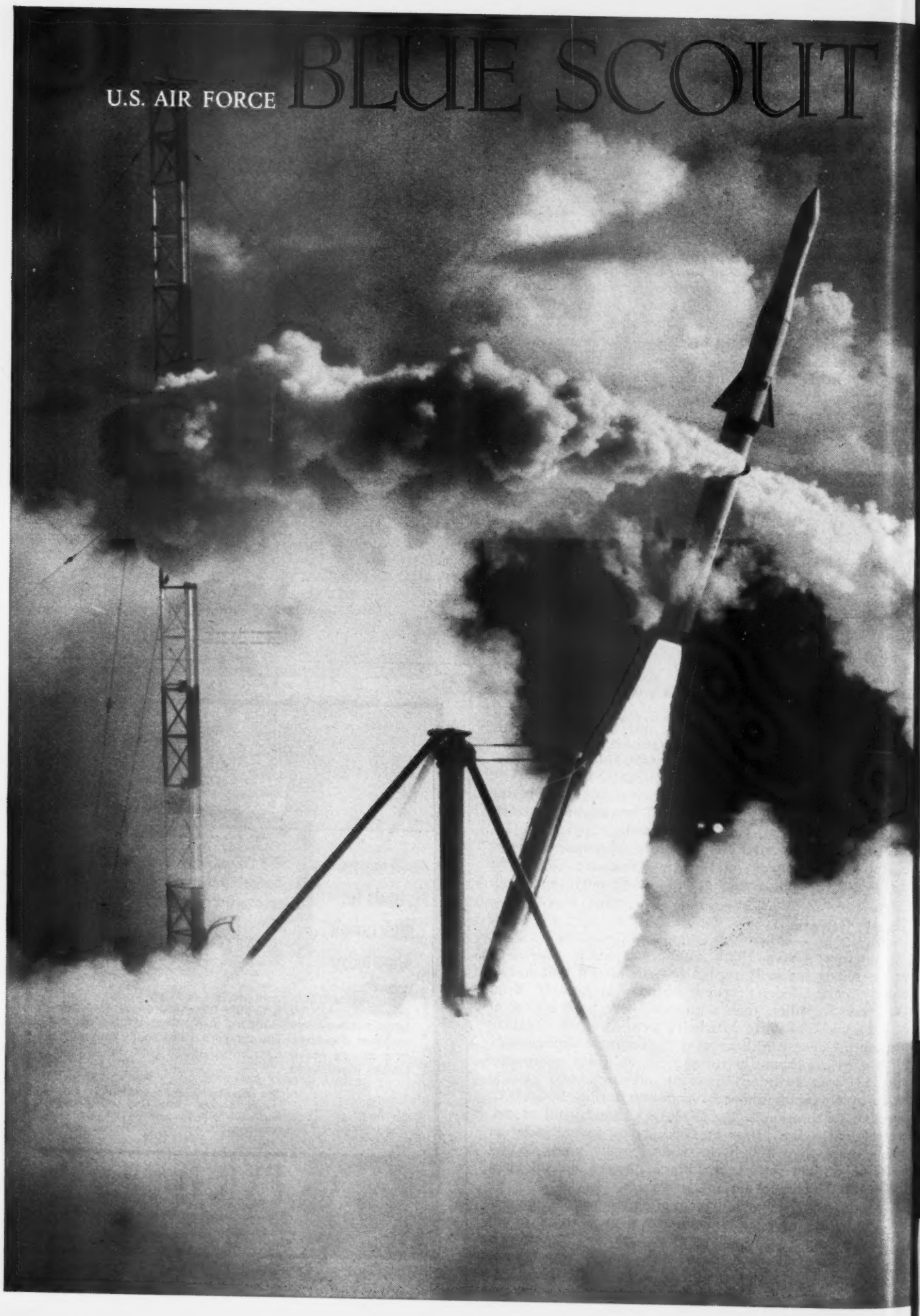
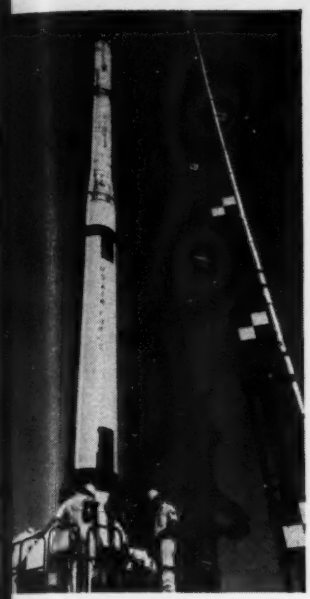

U.S. AIR FORCE
BLUE SCOUT



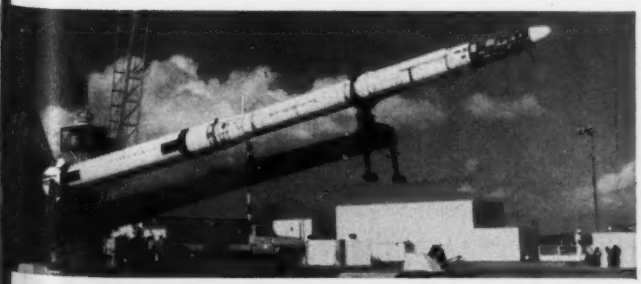
U.S. AIR FORCE PHOTOS

*LEFT:* USAF technicians of 6555th Test Wing under technical supervision of Aeronutronic engineers erect Blue Scout on simplified launch pad prior to successful flight. The development of Blue Scout effectively bridges gap between larger, more expensive ICBM's and smaller sounding rockets in our advanced space research and test programs. The Blue Scout is the largest solid fuel missile ever fired at Cape Canaveral.

*OPPOSITE:* U. S. Air Force Blue Scout Jr., lifts off launch pad as spin rockets ignite. This unguided 4-stage missile was successfully launched on the first attempt.

**The United States Air Force Blue Scout Program** provides the Nation with a new and versatile low-cost family of test vehicles to support our military weapons and space systems development programs. It can be used in a variety of deep space probes, orbit missions, boost glide trajectories, and as a rocket and satellite command and control communications system. Blue Scout has already fired a 32-pound scientific payload 16,000 miles into space ...and a 392-pound payload in a controlled trajectory 1400 miles down the Atlantic Missile Range. Aeronutronic is systems engineer, payload and test contractor on this important Air Force program.

AERONUTRONIC DIVISION *Ford Motor Company*, DEFENSE PRODUCTS GROUP
FORD ROAD, NEWPORT BEACH, CALIFORNIA

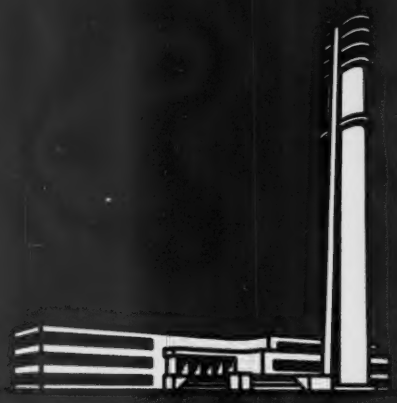


*Write for information about Aeronutronic's capabilities and the career opportunities open for engineers and scientists.*

*The Blue Scout program, based on modifications of the NASA Scout, is under the executive direction of the U.S. Air Force Ballistic Missile Division, Air Research and Development Command. Above LEFT:* Blue Scout is raised to a firing position on simplified launch pad. Because missile requires minimum ground support equipment, it is operable in a number of various field environments at minimum cost. *RIGHT:* Instrument package of Blue Scout is checked by Aeronutronic personnel and Air Force technicians. Accurate guidance system, data recovery system and final stage attitude control make Blue Scout adaptable to a wide variety of applications.

# ITT JOINS TWO DIVISIONS TO FORM ITT FEDERAL LABORATORIES

for a total capability in military electronics



This new major division of the worldwide ITT System has been created by combining ITT Laboratories and ITT Federal Division to form a single operating unit. The consolidation unites one of the nation's foremost research-and-development organizations with one of its outstanding electronic manufacturing companies and provides the new ITT Federal Laboratories with an unprecedented capacity to serve the military, as well as industry.

ITT Federal Laboratories represents the most up-to-date embodiment of the unified research-engineering-production approach in electronics. Its talents and facilities embrace the fields of communications, missile and space systems, electronic defense, avionics and the physical sciences. Backed by ITT's matchless resources throughout the free world, this new ITT division has a total capability to research, develop, produce and manage major systems in these areas and offers its customers a standard of service that sets a new high for the industry.

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A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

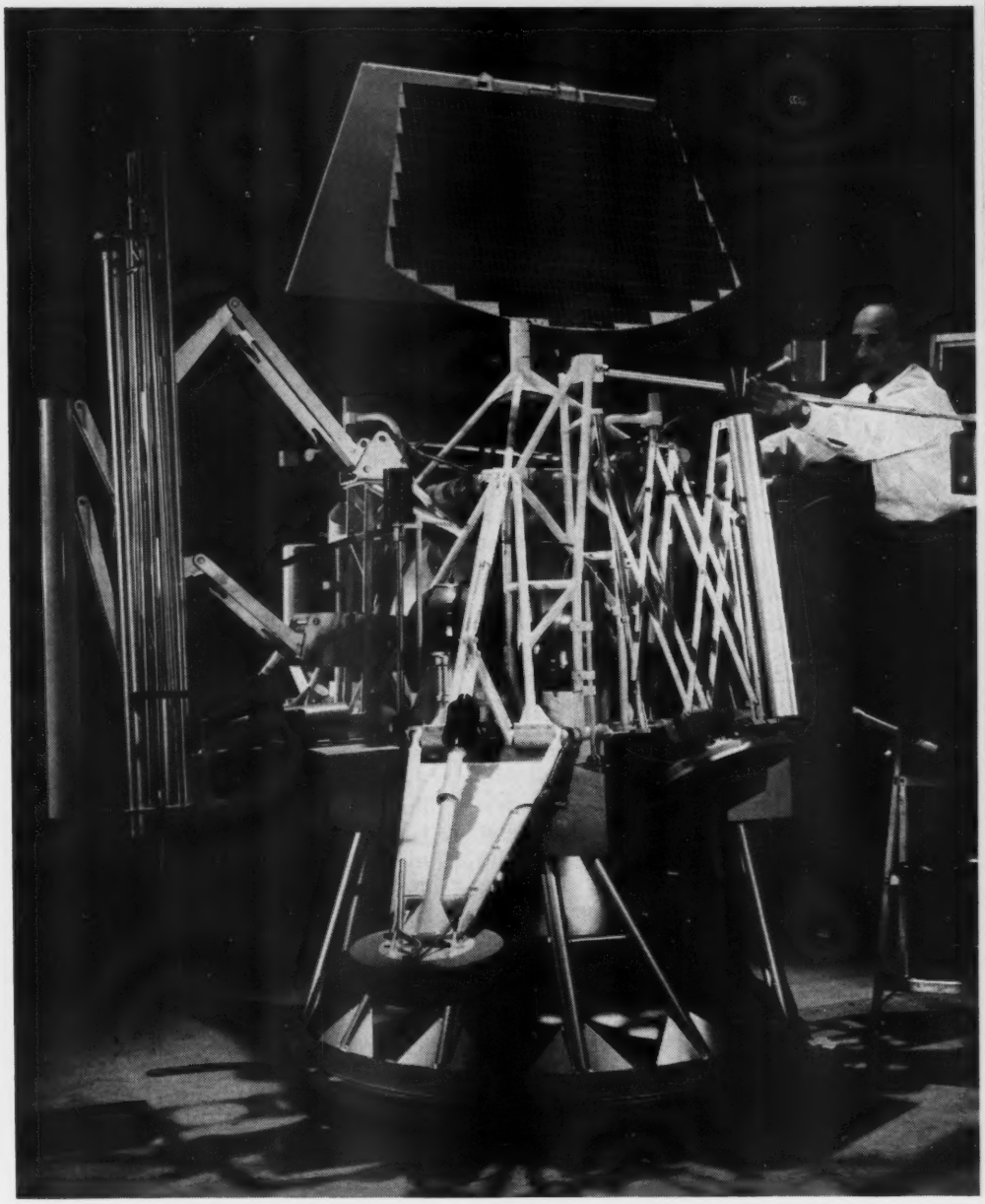
# TECH TALK

Contract for the design and construction of **seven Surveyor vehicles to soft-land on the moon** at five to ten miles per hour are being negotiated with the **Hughes Aircraft Company** by the **National Aeronautics and Space Administration.** Hughes won a four-company competition to get the job. Under the current plan the seven Surveyors will be launched to the moon between 1963 and 1966 by **Atlas-Centaur rockets.** They will weigh about 750 pounds after the moon landing, of which 250 pounds will be scientific instruments and 500 pounds communications equipment structure and an environmental system. As it is injected into orbit, a **Surveyor will gross about 2,500 pounds, including the 750-pound landing vehicle and large solid-propellant rockets.** These rockets will be for midcourse to control the trajectory with great accuracy, and for retrofiring to slow the vehicle prior to landing *(see cut).*

Scientific instruments aboard the Surveyors will include: **television cameras** to send a detailed picture of the lunar terrain to the earth; a **drill** capable of penetrating eighteen inches into the moon's crust; **automatic equipment to** analyze the drill specimens and send the results to earth; and **devices** to measure gravity, the magnetic field, and radiation balance, and to analyze the atmosphere.

Surveyor is the second of a group of three types of lunar exploration vehicles planned by NASA to **pave the way for manned landings there.** The first vehicle type, the **Ranger**, of which there will be five, will begin its flight program in the very near future. **It is due to be completed in 1962.** The first two Rangers will perform scientific experiments in orbit and test many of the systems to be used in later lunar flights. Hard moon landings of small instrument packages at almost 300 miles per hour will be attempted with the final three Rangers. Ranger design and preparation is primarily an in-house project of **NASA's Jet Propulsion Laboratory** with some subcontracting to industry. In the Surveyor management setup, Hughes is responsible for all elements of design, construction, and functioning.

The final and most sophisticated of the NASA unmanned moon exploration vehicles is the **Prospector,** which will be able to move across the lunar surface, explore a large area, and return samples of lunar material to earth. It will be contracted out to industry in the same manner as Surveyor. **Later this year several companies will be selected to compete for the Prospector design.** Launching vehicle for the Prospector will be the **Saturn 1.5 million-pound-thrust rocket.** Its schedule calls for lunar landings in the 1966-70 period.



**Full-scale mockup of the Surveyor, moon landing robot for NASA, is shown above by a Hughes Aircraft Company engineer. Instruments will be carried aboard the Surveyor to explore and analyze the moon's surface. They are attached to extendable arms which are secured to truss work around a large spherical rocket which will slow the Surveyor's landing speed to from five to ten mph.**

* * *

Slow but certain progress is being made toward the formation of a **cooperative European program for non-military space research.** Scientists from **twelve European nations** held several unofficial discussions during 1960 to decide just what the objectives of such a program should be and how it should be organized and financed.

These discussions led to two conferences in which the governments were officially represented. One was held late last year in Geneva and one in January in Strasbourg, France. The major points of disagreement in the

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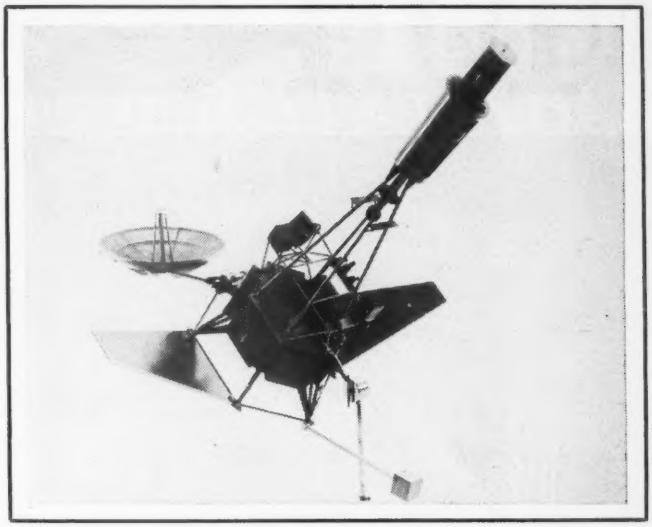


**First US moon landing vehicle is the NASA Ranger, right, which will hardland a load of instruments in about a year according to current schedules. The spherical instrument landing package is in the cylindrical section in the upper right of photo. NASA's Jet Propulsion Laboratory is managing the Ranger's design, construction, and functioning.**

last conference concerned **launch vehicles and whether they should be purchased from nations which already produce them or should be built cooperatively in Western Europe. France** and **Great Britain** have taken the lead in initiating these conferences. The other nations attending them have been: **West Germany, Italy, Austria, Belgium, Spain, Norway, the Netherlands, Sweden,** and **Switzerland.**

* * *

A long-range version of the **Quail decoy missile** built by **McDonnell Aircraft Corp.** for the **Strategic Air Command** is under flight test at Eglin AFB, Fla. The new GAM-72A missile has a larger fuel capacity than the first Quail model. It could accompany B-52 bombers for several hundred miles through enemy defenses. The **4135th Strategic Wing, SAC,** is conducting final flight testing of the GAM-72A before it is used by operational units.

* * *

The **RAND Corporation** estimates that it costs the Air Force about $2 per year to maintain every dollar's worth of airborne electronic equipment that it operates. The average life of this equipment is between four and five years. So its total cost is **more than ten times** its purchase price.

* * *

**Indian nuclear capability** is rapidly approaching the point where the nation will be able to manufacture atomic weapons. **Prime Minister Nehru** made this assertion recently as the **second power-producing reactor was placed in operation by the Indian government** at its atomic energy establishment on the outskirts of Bombay.

The present Indian policy, however, is **not to produce nuclear arms** under any circumstances and to make every possible **public and private effort to persuade other nations not to do so either.** Mr. Nehru has been pressing both East and West for an early and effective agreement on control of atomic arms. He has been emphatic in insisting that **Red China** be included in this agreement and in all of the negotiations that lead to it.

The new **power-producing reactor at Trombay** outside **Bombay** was designed and constructed primarily by **Canadians.** Their technical assistance has been instrumental in building Indian nuclear capability. Canada is the first nation with substantial nuclear know-how to refrain from putting it to military use. An Indian-designed and constructed zero-energy reactor is also available at Trombay for experimental purposes.

* * *

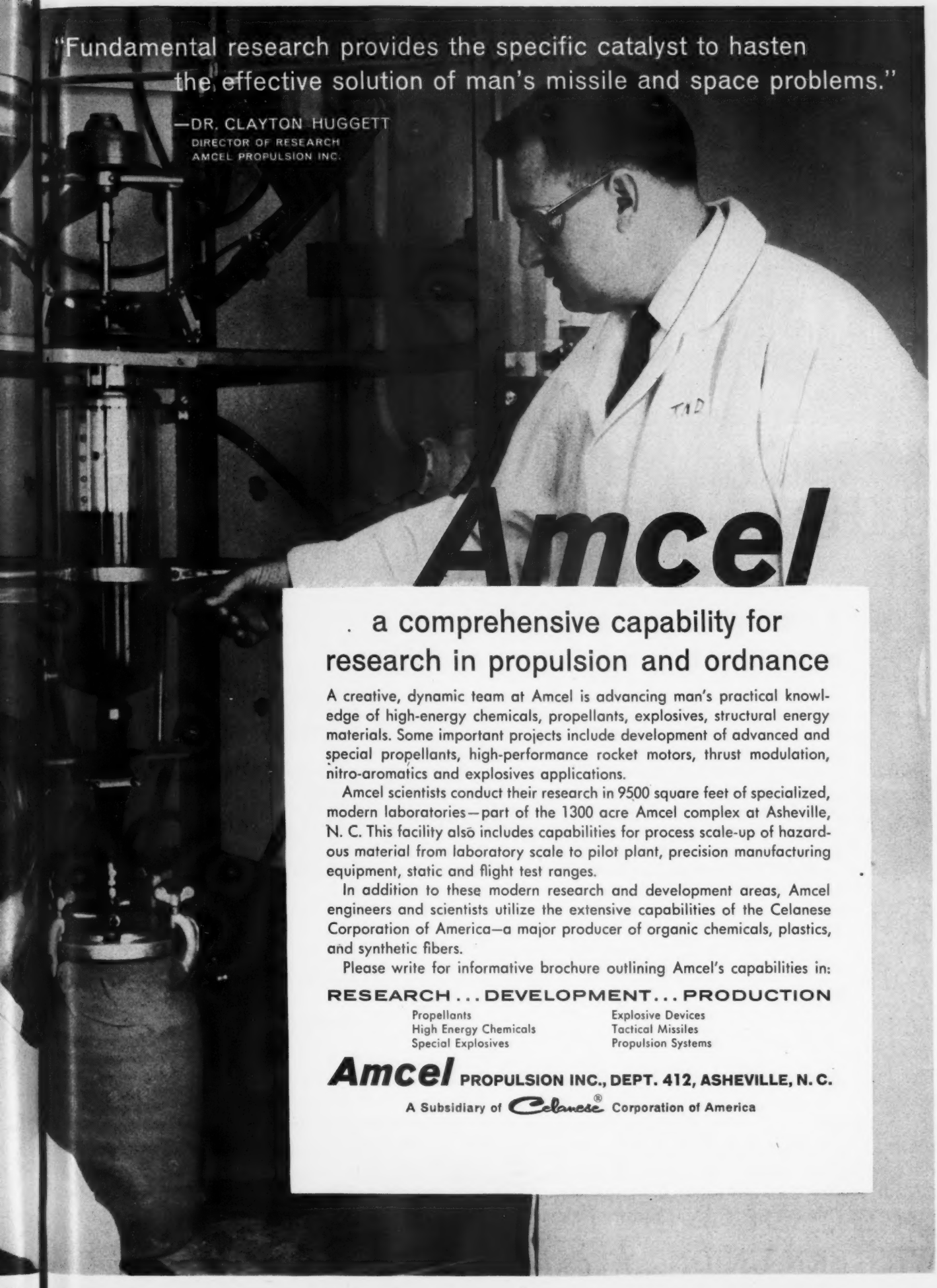
**Australia** has ordered **thirty Mach 2 Dassault Mirage III fighter planes** to modernize its air force. This is the first successful sale of the Mirage III in competition with the **Lockheed F-104. Japan, Canada,** and **West Germany** all selected the F-104 from a field of several aircraft including the French fighter. A major portion of the manufacture of the Mirage III and its **SNECMA Atar turbojet engine** will be conducted in Australia. Australian-built Sabres will be replaced by the Mirage III.

* * *

A detailed study contract for a **flexible-wing recovery system** for the **Saturn vehicle's first-stage booster has** been let to the **Ryan Aeronautical Company** by the **National Aeronautics and Space Administration.** Several years of research on flexible wings made of cloth have been carried on at **NASA's Langley Research Center** by a group under **Francis Rogallo.**

Rogallo's wing is also under serious

*(Continued on page 113)*


"Fundamental research provides the specific catalyst to hasten the effective solution of man's missile and space problems."
—DR. CLAYTON HUGGETT
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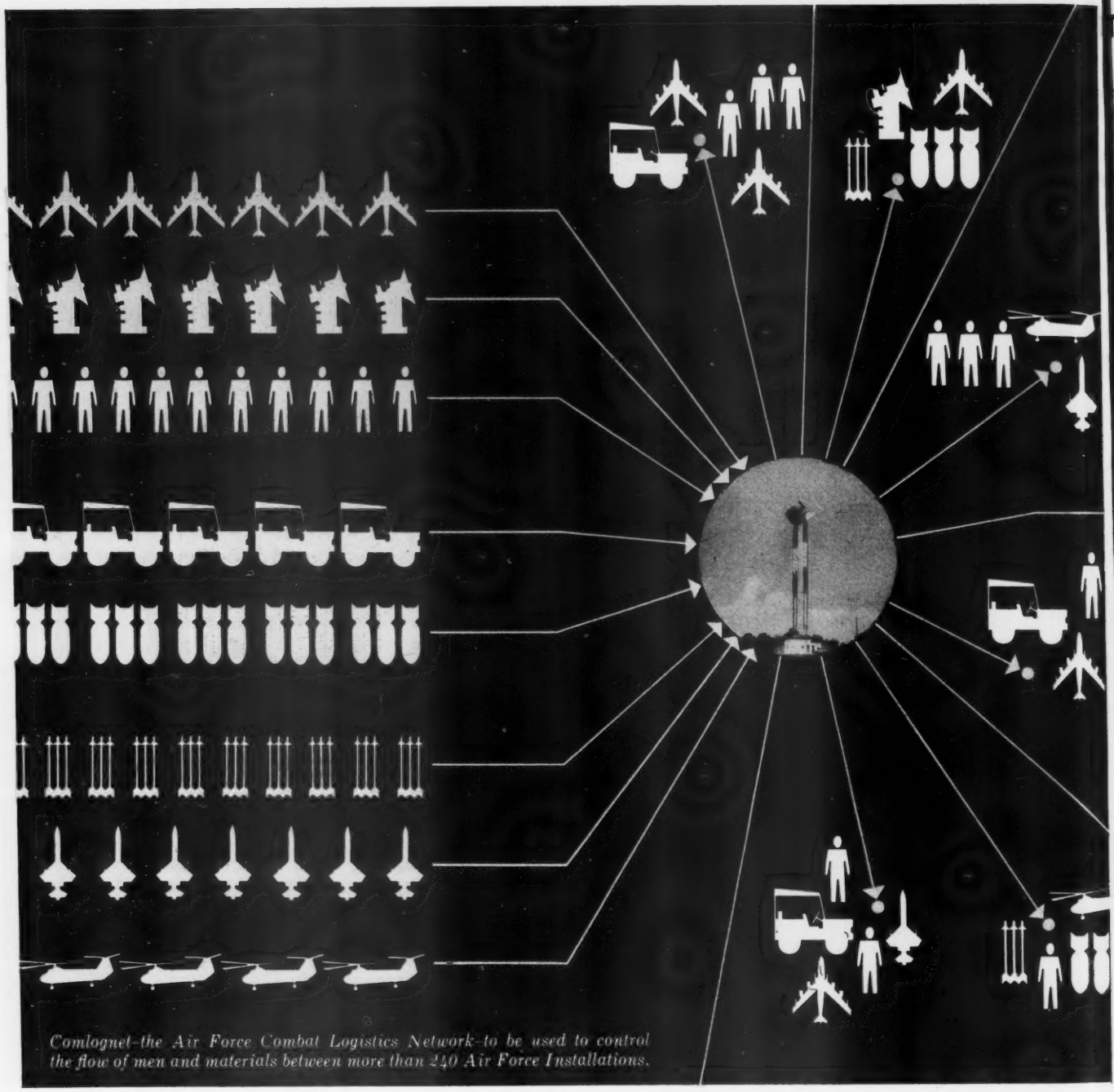


*Comlognet–the Air Force Combat Logistics Network–to be used to control the flow of men and materials between more than 240 Air Force Installations.*

# COMLOGNET:
## *world's most advanced data communications system designed for the Air Force by Western Union.*

This instantaneous communications and data network has the capability of handling every known form of electronic communications swiftly, accurately, and automatically. Upon completion in 1962, Comlognet will have a daily capacity of seven million punched cards in its five U.S. centers, making it the world's largest data processing system. Future expansion, including the handling of data from overseas installations, will be readily accommodated.

Modernization of Comlognet is another first for the U.S. Air Force and Western Union. Acting as prime contractor, Western Union designed and engineered this electronic network in participation with other companies.

WESTERN UNION...*finds better ways to speed it electronically*

consideration for use on orbital vehicles during reentry. Research is being conducted on several types of **metal fabrics impregnated with high-temperature plastics** to meet reentry heating conditions. Rogallo's flexible wing has many of the characteristics and advantages of a kite. It is very light with an exceedingly large area. It will give any vehicle a very low wing loading so that it will come down slowly when gliding from any altitude at any speed. The slow descent results in a low heating rate which can be withstood by the metal fabric wings, according to current estimates.

Another possible use for this large flexible wing is to deploy it as an **auxiliary lifting surface during the landing of supersonic aircraft.** Wind-tunnel tests of this type have been run with models of the B-70 equipped with Rogallo's wing. In this **"biplane" configuration the B-70's landing speed was reduced considerably** and its stability was not adversely affected. However, the use of this device undoubtedly will not be necessary in the B-70's case because its normal landing speed and other landing characteristics are well within currently accepted limits.

* * *

Installation of **110 runway overrun barriers** at Air Force bases throughout the world will be handled under a $5 million contract with the **E. W. Bliss Company of Canton, Ohio.**

The Bliss barriers consist of light nylon tapes which are drawn over pulleys at the side of the runway and are braked by an underground engine about five feet in diameter. **The system will stop the heaviest jet fighter traveling 210 miles per hour within 1,000 feet.** It can be used by all aircraft regardless of whether they have arresting hooks. At some bases the new equipment will replace barrier systems now in use. In other cases it will augment current operational systems.

* * *

A **protective suit** which will resist strong radio frequency and microwave radiation has been developed for the **Air Defense Command** by the **Wright Air Development Division, ARDC.** The suit allows technicians to perform emergency repair and maintenance operations on **Ballistic Missile Early Warning System** (BMEWS) stations while they are in operation.

BMEWS stations develop peak powers of around one billion watts. The very strong radiation fields near them can cause crippling internal injuries. It will be possible with the new protective suits to stay in most of the **radiation fields for short periods.** Design philosophy was to reflect as much of the radiation energy as possible to prevent a rapid internal temperature rise. The one-piece suit includes **mittens, head covering, and boots.** Its four-layer construction has neoprene-coated nylon on its outer surface, two layers of reflective silverized cloth, and a cotton liner to make the suit easy to don and adjust.

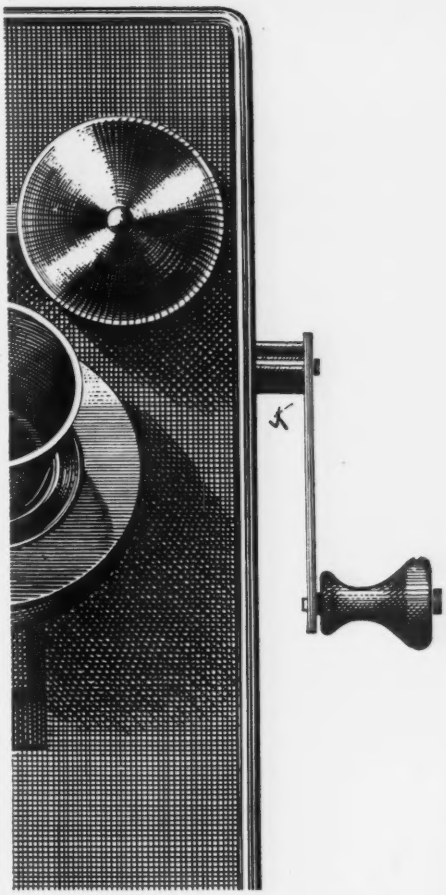
* * *

The most efficient way to maneuver a satellite or space vehicle is to get an assist from the atmosphere, according to Howard London of the **United Aircraft Corp. Research Laboratories.** Mr. London has shown in a recent paper that large amounts of fuel can be saved by skipping into the atmosphere and making a turn to change the orbital plane of a satellite. The fuel required to deflect a space vehicle into the atmosphere and reaccelerate it back to orbital speed after the turn is much less than the fuel required to make a change of orbital plane while staying in space.

The lifting ability of the space vehicle determines just what fuel savings are possible. If a vehicle's lift is equal to twice its drag the fuel savings which can be expressed as a velocity increment are equal to about 1,750 feet per second for a **ten-degree change** of inclination. A **ninety-degree change** of inclination will save 19,700 feet per second in velocity increment. This is about three-quarters of the velocity needed to send the vehicle into orbit from the ground in the first place. If a vehicle can develop four times more lift than drag then it can make a **ninety-degree change** in orbital plane in the atmosphere for the same fuel that it can make a **twenty-three-degree change** in space.

The fuel economy of the atmospheric maneuvering system would be useful for any type of vehicle firing antisatellite missiles because for this mission it is very **advantageous** for the interceptor to be in the **same orbital plane** as the target. The system would also allow any launch point to economically launch equatorial or polar satellites.—END

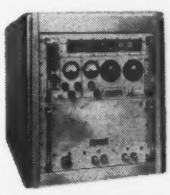
NOTE: Any book reviewed in "Airman's **Bookshelf**" *(see page 121)* may be obtained, postpaid, from the AeroSpace Book Club, Mills Building, Washington 6, D. C. Full payment must accompany order. Book Club members are eligible for substantial savings on Club selections.

SIGNAL GENERATOR

BSG-9 is a test generator for FM radio receivers operating in the range of 406 to 549.5 megacycles and using carrier deviations up to ±300 kilocycles. It features continuous tuning across the frequency band and direct readout of the generated frequency. BSG-9 provides frequency modulated r-f carrier signals of known frequency and amplitude with an accuracy to .005%. It is self-contained, portable and designed as a laboratory standard, but sufficiently flexible for production testing or field maintenance of FM equipment. It is produced by Babcock, the world's foremost designer and manufacturer of remote control and guidance systems.

*BABCOCK— a productive environment for interesting Electronic Engineers*



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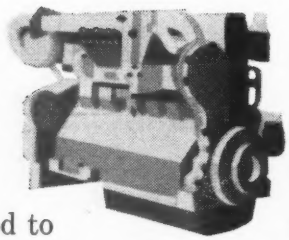

*Problem:* To develop more horsepower without increasing diesel engine size. *Needed:* A new method to increase fuel burning capacity without robbing engine horsepower. *Developed:* A responsive turbocharger being used in Caterpillar's compact, high horsepower diesel engines. This advance in engine efficiency was the result of a Caterpillar research group which devoted itself exclusively to turbo study and testing. Today, the company is one of the world's leading authorities on high-speed rotational phenomena, the problem and their control. • In conjunction with turbocharger manufacturers, Caterpillar has also pioneered in the field of turbocharged engine performance and proper matching of turbo and engine. As a leading manufacturer of heavy equipment, Caterpillar has outstanding resources in research, engineering and manufacturing. This experience, talent and manufacturing capacity are available for your vehicle, engine and component needs. Write for Bulletin No. 40-20265, Defense Products Department, Caterpillar Tractor Co., Peoria, Illinois.

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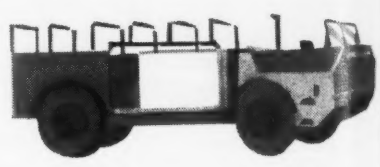


# AFA NEWS

## SQUADRON OF THE MONTH

*Billy Mitchell (Milwaukee) Squadron, Cited for effectively memorializing the name of the USAF's pioneer airman, thereby contributing to a better community understanding of airpower.*

**Dr. Lawrence G. Derthick,** Commissioner of the US Office of Education for the past four years and now Assistant Executive Secretary of the influential National Education Association, has become **chairman of AFA's important Aerospace Education Council.** Dr. Derthick's appointment assures AFA effective guidance and leadership in this vital post.

Other members of the council are **Dr. Irby Carruth,** Superintendent of Schools, Austin, Tex.; **Dr. Hubert Wheeler,** Commissioner of Education, State of Missouri; **Dr. Calvin H. Reed,** Professor at the University of Nevada; **Craig Minear,** Executive Secretary, Colorado Education Association; and **Dr. Lindley Styles,** Dean of the College of Education, University of Wisconsin.

Consultants appointed to the council by **AFA President Thos. F. Stack** include **Dr. Wayne O. Reed,** US Deputy Commissioner of Education; **Dr. Frank E. Sorenson,** Professor at the University of Nebraska and chairman of the council last year; **Donald F. Kline,** Research Director, F. E. Compton Co., Chicago; **Austin McCaffrey,** Executive Secretary, Textbook Publishers of America; **Dr. Charles H. Boehm,** Pennslyvania Superintendent of Education; **Peter J. Schenk,** Assistant to the President of MITRE Corp., Lexington, Mass., and former AFA President; **Col. William C. Lindley,** Director, Education Division, Personnel Procurement and Training, Hq. USAF; and **Dr. James G. Allen,** Chairman of the Department of History, University of Colorado, Boulder, Colorado.

The council is currently involved in planning and implementing a series of educational seminars at several metropolitan centers. To date these programs are planned for **Boston, Detroit, Pittsburgh, Ogden, Las Vegas,** and **Dallas.** Others are in the planning stage. The programs in each instance are cosponsored by AFA, the state's

*(Continued on following page)*

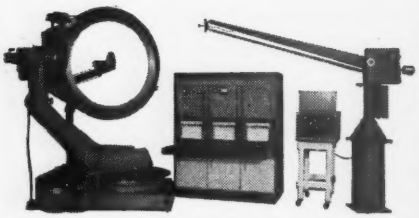
**Surplus Air Force F-86 fighter, famed Sabrejet of Korean War air battle, was placed in school playground by Mt. Clemens, Mich., AFA Squadron. Plane was reclaimed from USAF's vast hardware scrap heap at Davis-Monthan AFB, Ariz.**

**Taking part in Eagle Scout Award ceremony at Lincoln AFB, Neb., for Walter Berg, Jr., second from left, were (left to right) his father, Col. Walter Berg of Lincoln AFB, Mrs. Berg, Mayor Boyles of Lincoln, Maj. Ralph H. McKay, Explorer Scout Adviser of Scouting Squadron to which youth belongs, and Lt. Col. Ralph Reed, AFA Wing Commander. AFA unit sponsors the Air Explorer Squadron. Many Association Squadrons, Wings sponsor local Scout Squadrons.**

**AFA Mitchel Squadron, N. Y., awards honorary membership to Col. John O. Hall, Commander of Mitchel AFB, N. Y. The colonel was the AFA Squadron's Man of the Year. Presentation was made by Squadron Cmdr. Howard Eichner.**

## Boresight Accuracy

## Tested Automatically



- Tests Type I and Type II to MIL-R-7705A(ASG)
- Automatically records boresight error, percent transmission, antenna patterns
- Accuracies greater than ±0.1 milliradian (1°/175)
- Test and align doppler antenna systems
- Flight line boresighting

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## AFA NEWS — CONTINUED

**Dr. Lawrence G. Derthick, left, new head of AFA's Aerospace Education Council, congratulates Dr. Wayne O. Reed, Deputy Commissioner, US Office of Education, after latter received AFA's Vandenberg Trophy for his contributions to education in 1960.**

Department of Education, and the Arnold Air Society, and are meeting with enthusiastic approval.

* * *

The fifth annual **Billy Mitchell Memorial Award Dinner** of the Milwaukee AFA Squadron which bears his name was held on January 21. Guest speaker was **Maj. Gen. Robert E. L. Eaton,** Assistant Chief of Staff for Reserve Forces, USAF.

**Mrs. Martin A. Fladoes,** General Mitchell's sister, presented the annual Mitchell Award for outstanding contributions to airpower to AFA's Executive Director, **James H. Straubel.** The award goes each year to a native of Wisconsin. Mr. Straubel's home town is Green Bay. **Gary K. Ortmann** is Mitchell Squadron Commander.

In its relatively short history, this program has developed into one of the top affairs in the Milwaukee calendar, and is a credit to the Squadron, its officers and members, and the entire Association. It merits the Billy Mitchell Squadron accolades as AFA's Squadron of the Month, and a salute from AFA members everywhere.

* * *

The **Greater Miami Squadron** in January held a dinner meeting at Homestead AFB, Fla., Officers' Club. It was attended by members and guests from the Sunshine City. **Maj. Gen. Orval A. Anderson, USAF (Ret.),** current Executive Secretary of the Air Force Historical Foundation, was guest speaker.

General Anderson served at one time as **Commandant, Air War College,** and has had a long and interesting career. **He is a most challenging lecturer,** and the officers and members of the Miami Squadron report that they were treated to an interesting and thought-provoking evening.

**Brig. Gen. Edward "Bo" Barber, USAF (Ret.)** is Squadron Commander. The Squadron not long ago held a highly successful space-age briefing at Cape Canaveral.

* * *

**Lincoln, Neb., Squadron** sponsors an **Air Explorer Scout Squadron.** At a special ceremony on January 23 the Lincoln AFAers held a Court of Awards at which its first Eagle Scout badge was presented to **Walter Berg, Jr.,** son of USAF **Col. Walter Berg,** Commander, 307th Bomb Group, Lincoln AFB.

**Ralph L. Reed,** newly elected Commander of the Nebraska Wing, officiated at the ceremony, along with **Hon. B. E. "Pat" Boyles,** mayor of Lincoln, and **Col. William H. Working,** Commander, Lincoln AFB.

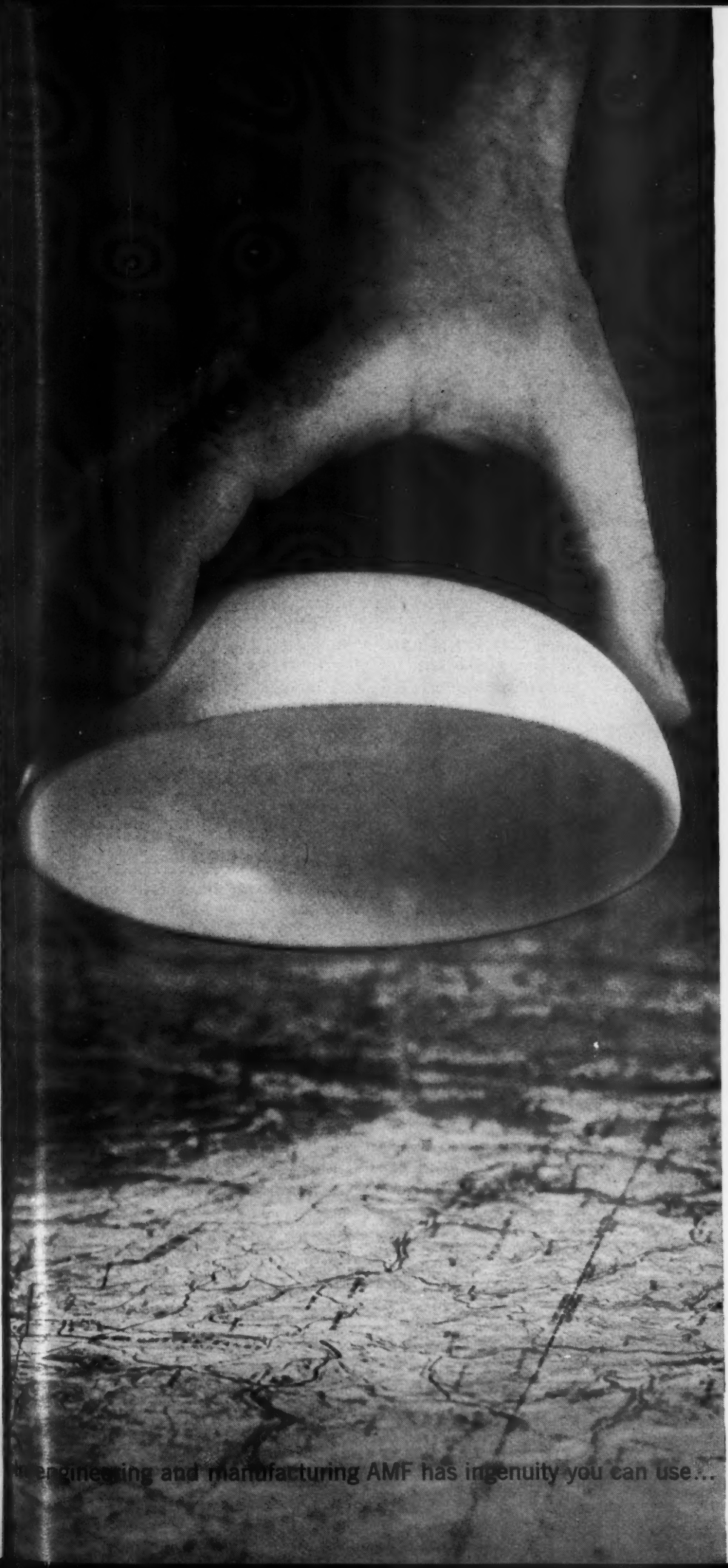
Several AFA Squadrons now sponsor Explorer Squadrons, and all of them share in the recognition given to AFA by the **National Boy Scouts** organization at the **1960 National Convention in San Francisco.**

* * *

The **Hunt Room of the "21" Club** in New York was the scene January 27 of a reception and buffet honoring **Julian B. Rosenthal,** who served for thirteen years as AFA's National Secretary and for one term as Chairman of the Board. In recognition of his long and dedicated service, several New York members headed by **Regional Vice President Fred Monsees** sponsored a "surprise" party for him. It turned out to be not too surprising, however, because several people called Julian to tell him they'd be there.

**Maxwell A. Kriendler,** President of 21 Brands, Inc., was an excellent host for the 100-plus guests who turned out to honor Rosenthal. Included

*(Continued on page 119)*



# He built the strongest roof in the world

This AMF engineer knows what it takes to shrug off megaton forces. He *had* to know because he designed the prototype atomic bomb shelter at Frenchman Flats, the only building that stood up under the force of the atomic bombs exploded there. Well, not altogether—a flange on the door *was* bent.

In order to design the shelter, he had to calculate the effect of the explosion on materials and structures. He had to know how the shock was transmitted through the earth's crust and what effect it would have on the shelter—from beneath as well as from above. And, after the dust of calculating had settled, he had the very practical problem of expressing the results in steel and concrete. He did so, successfully.

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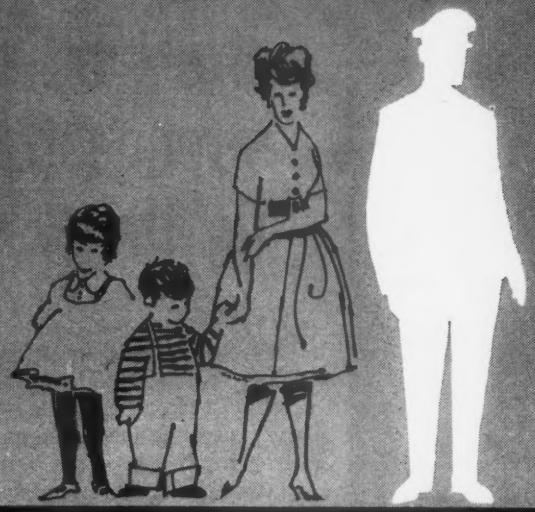

## *Would Your Family Have ENOUGH Money?*

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| 50-54 | 10,000 | 10,000 |
| 55-59 | 10,000 | 10,000 |
| 60-64* | 7,500* | 7,500* |

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I understand the conditions governing AFA's Group Life Insurance Plan. I certify that I am on active duty, that to the best of my knowledge I am in good health, and that I have successfully passed an Annual Physical Examination within one year.

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☐ I am currently on flying status.

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Air Force Academy Cadet Douglas Cairns accepts Maryland Wing check for $750 for Academy Stadium fund from AFA Executive Director James H. Straubel in Washington visit.

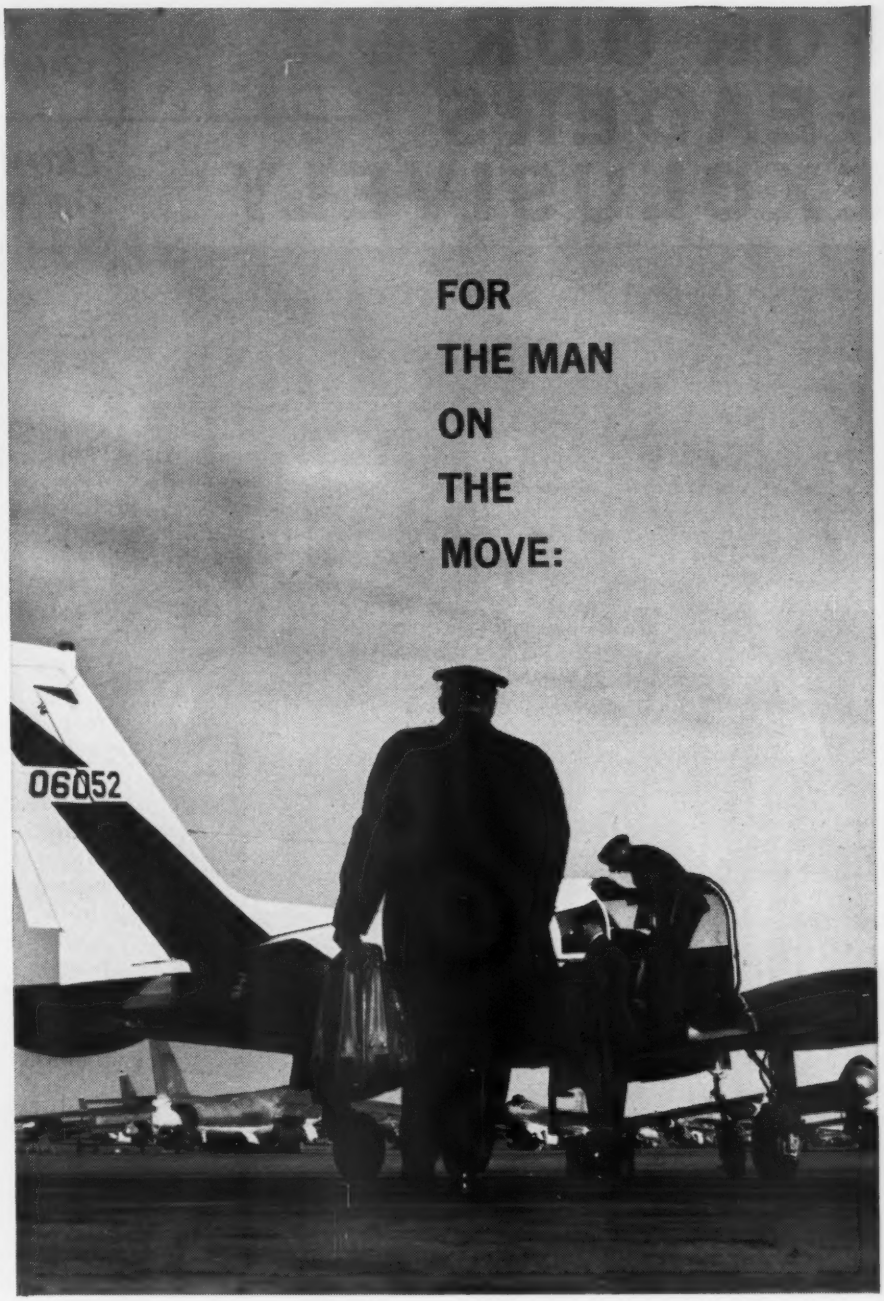
among them were National Directors **C. R. Smith, Paul Zuckerman, Roger Browne, Paul Fonda, Carl Long, John B. Montgomery, Don Strait,** and **Bud West,** National Treasurer **Jack Gross,** National Chaplain the **Rev. William Laird,** and Wing Commanders **Gordon Thiel** (New York), **E. M. Carnicelli** (New Jersey), and **Steve Yednock** (Pennsylvania).

° ° °

The **1961 National Convention in Philadelphia** doesn't take place until September. But the demand for hotel rooms is already great. We take this opportunity to remind members to check with their Squadron commanders for a special housing request card. At this point, these cards virtually guarantee that **one will receive the hotel room of his choice.** In weeks to come, it may be difficult to give this guarantee.

° ° °

**CROSS COUNTRY.** . . . This is the time of year when our Wings announce the dates of their own **annual conventions.** In order that we may furnish the details to all other Wings through these pages, Wings should send us the announcements as soon as possible. To date the only one we're aware of is the previously announced combined **Arizona-California-Nevada** meeting in Las Vegas April 7-9. . . . **Maj. Jim Laulis,** formerly spark plug of the California Wing's education program, is now stationed at Barksdale AFB, La. He informs us that the Shreveport Squadron plans an education seminar April 29 at Centenary College. Jim and **Dick Goldfogle,** one-time Michigan Squadron Commander who is also stationed at Barksdale are working together on this program. —GUS DUDA

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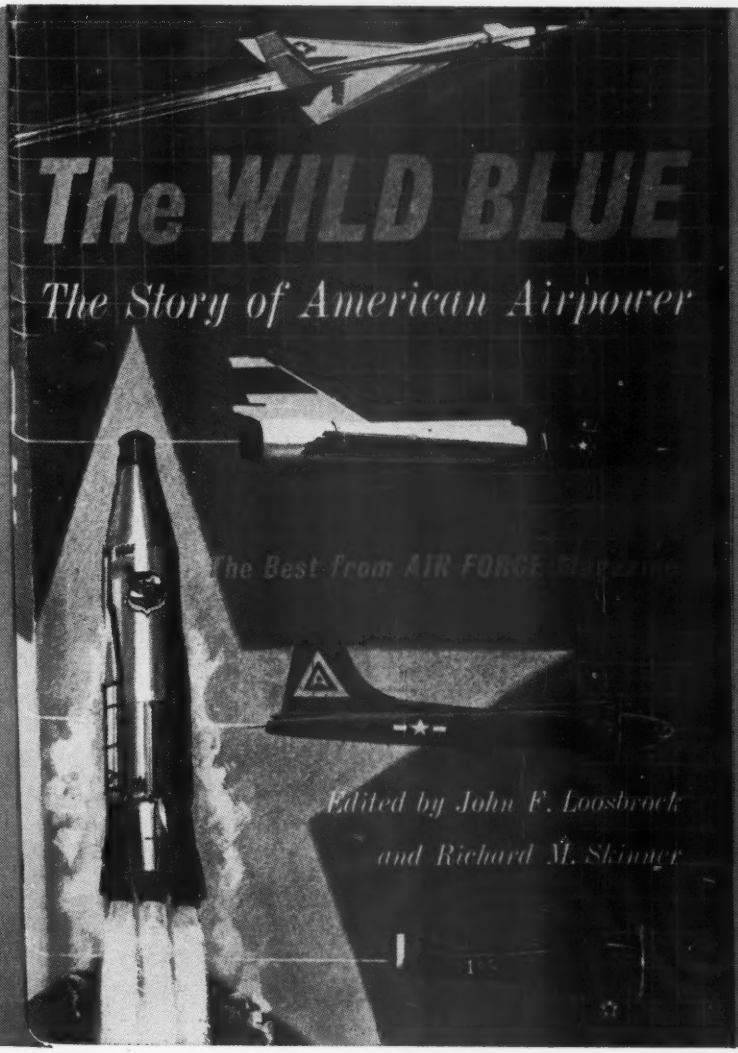
The WILD BLUE
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The Best from AIR FORCE Magazine
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and Richard M. Skinner

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# airman's bookshelf

## Aviation History

A number of interesting new volumes of aviation history have appeared. British writer Charles H. Gibbs-Smith's *Aeroplane: An Historical Survey* (Her Majesty's Stationery Office, London, $6.53, distributed by British Information Service, 45 Rockefeller Plaza, New York) is an over-all look at aviation's beginnings. It traces flight in detail from Sir George Cayley, the father of British aviation, to World War I. It deals more generally with flight from Greek mythology to rockets and missiles. Air historian Marvin McFarland has called this book the "finest survey history of the aeroplane that has yet been compiled . . . a new high mark in the writing of aeronautical history."

In *The Aces* (Putnam's, $4.95) author Frederick Oughton creates a highly readable popular history of the men, the airplanes, and the actions of the first great war in the air. Oughton devotes prime attention to the war's colorful aces, their deeds and accomplishments.

Two decades later another generation of men and aircraft appeared in the same skies. One combat plane that very much distinguished itself was the British Supermarine Spitfire. It was the only craft to remain in production and combat throughout the entire war. Its two-volume, well illustrated biography, *Spitfire: The Story of a Famous Fighter,* by Bruce Robertson (Harleyford Publications, Letchworth, Herts., England, $8.50), traces in twenty-four chapters the research, development, production, and combat history of the Spitfire and its close naval kin, the Seafire.

More than five years of painstaking research produced Ray Wagner's monumental *American Combat Planes* (Hanover House, $9.95). This is a comprehensive, illustrated history of American military aircraft from the World War I era to the B-70. All combat types built for the Air Force, Navy, and foreign governments are included as well as foreign aircraft procured for American units.

Volume II of William Green's *Famous Bombers of the Second World War* (Hanover House, $3.95) continues the study of the principal bombardment aircraft of all nations involved in World War II. Volume I was published in March 1960. American bombers featured in the current volume are the Douglas A-20 and the Boeing B-29 Superfortress. Others include the Bristol Blenheim, the Mitsubishi KI-21 (Type 97), Armstrong Whitworth Whitley, Handley Page Hampden, Short Stirling, Mitsubishi GAM Type 1, Focke-Wulf FW-200 C Condor, Handley Page Halifax, Heinkel HE-177 Greif, Mitsubishi KI-67 Type 4 Hiryu, and the Arado AR-234B Blitz.

Sixth in David C. Cooke's popular *Planes That Made History* series, is *Flights That Made History* (Putnam's, $2.50). This concise photo-narrative history of thirty-seven epic flights—milestones in the conquest of the air—ranges from the first Wright Brothers' flight and Bleriot's English Channel crossing to the B-52 nonstop round-the-world venture in 1957. This one is aimed especially at the young adult.

Many World War II vets have poignant memories of long hours spent over treacherous North Atlantic waters on the Atlantic ferry route. This bomber-delivery airway was one of Britain's lifelines during the dark hours of early World War II. Canadian author Sholto Watt writes of this operation in *I'll Take the High Road* (Brunswick Press, Fredericton, N. B., Canada, $4.95).

## Aerospace Books

Robert J. Serling, manager of Washington's UPI Radio News Bureau, digs into the causes and the lessons learned from tragic air crashes to write the finest full account of this controversial subject to date. *The Probable Cause: The Truth About Air Travel Today* (Doubleday, $3.95) is a nontechnical account of major air disasters, subsequent investigations, and actions taken. The book is based on official CAB investigation and reports, personal interviews with survivors, witnesses, and so on. Reading this volume, one connected with aviation must feel proud of accomplishments in air safety. Aviation's record is second to none in the field of public transportation.

* * *

Several AF officers have written new aviation books. Maj. (Chaplain) Connor B. Cole of Fairchild AFB writes about the experiences of three chaplains serving in World War II and the Korean War—a minister, a rabbi, and a priest. *The Cross and the Star* (Vantage Press, $4.95) is a well written, moving novel of tragedy and hope, of life's fears and evils, of three men of three faiths but one God.

Air Force Academy Assistant Professor of History Capt. David H. Zook, Jr. (Ph.D, Ohio State) makes a scholarly contribution with *The Conduct of the Chaco War* (Bookman, $6), a volume which examines the military, diplomatic, and political aspects of the Bolivian-Paraguayan conflict, 1932-35.

Maj. Earl Snyder, a member of the JAG at Shaw AFB, S. C., translates military law into a handbook for the serviceman on the street and his dependents. *Every Serviceman's Lawyer* (Stackpole, $3.50) tells what the law is in thirty-three different fields such as promotion, military justice, marriage, overseas assignments, mortgages, taxes, dependents, etc., subjects that have legal aspects in daily military life. It contains nearly 1,000 examples of the law and more than 400 definitions of legal terms.

* * *

British author K. G. Williams explores the problems, research, and accomplishments of aeromedical science in adapting man to survive at high altitudes and speeds. *The New Frontier: Man's Survival in the Sky* (Thomas, $5.50) deals with human physical and mental limitations brought about by rapidly advancing technology. It is a book which will interest flight surgeons, aeromedical specialists, and flyers.

* * *

For sheer jet-age flight suspense Marine Lt. Col. William Rankin's *The Man Who Rode the Thunder* (Prentice-Hall, $3.95) is hard to beat. Rankin, cruising at 47,000 feet in his Marine jet F9F-2, suddenly noted engine fire, bailed out at near-sonic speed without a protective pressure suit. He free-fell nearly seven miles into a vicious thunderstorm. Opening his chute, he was caught by the thermal activity and kept suspended for over forty minutes inside the storm by the tremendous wind currents and vertical drafts. Hail and rain pelted him mercilessly. Colonel Rankin's experience has been studied with interest by aviation physicians.

* * *

A new look at Soviet space tech-

*(Continued on following page)*

nology is given in Dr. Albert Parry's *Russia's Rockets and Missiles* (Doubleday, $4.95). Parry, a Russian-born scholar, draws heavily on published Soviet technical journals in putting together the story of Russia's rocket and missile beginnings, rockets in use in World War II, progress in the immediate postwar period, use of captured German rocket experts, and the rapid development made in rocketry, satellites, and space probes in recent years. He discusses their present state of the art in Russia, the rivalry of the two great world powers, the men, facilities, hardware involved in Soviet space programs, the equipment and capabilities the USSR possesses in military and scientific missilry.

• • •

Free-lance author Shirley Thomas has completed her first volume in a projected series of thirteen on leaders of space research, development, and exploration. *Men of Space* (Chilton, $3.95) contains detailed biographies of ten prominent figures in astronautics—pioneers whose work has made major advances possible, Krafft Ehricke; Robert H. Goddard; Lt. Gen. Bernard A. Schriever, USAF; Col. John Paul Stapp, USAF; Konstantin E. Tsiolkovsky; Dr. James Van Allen; Dr. Wernher von Braun; Dr. Theodore von Kármán; Dr. John von Neumann; and Lt. Col. Charles Yeager, USAF.

• • •

A longtime AFA member, and Secretary of the Sacramento Airpower Council, author Clive Davis follows his successful *Man in Space* with an appropriate sequel, *Messages from Space* (Dodd, Mead, $2.75). This one describes how we get information back from missiles and space probes, sounding rockets, satellites, shows how satellites are controlled, orbits predicted, information collected, stored, and reported back. It also looks to the future of satellites as space navigation and communication aids.

• • •

*Reaching for the Stars,* by Erik Bergaust (Doubleday, $4.95) examines the life and work of Dr. Wernher von Braun. Bergaust's biography of this famous space scientist covers little-known episodes of Von Braun's career in early German rocketry, his role in the World War II Nazi rocket research and development, troubles he had with the Gestapo, which arrested him for sabotage.

• • •

Another discussion of the well publicized Project Mercury is presented by Don Myrus in *The Astronauts: The True Story of Man's Greatest Adventure in Outer Space* (Grosset & Dunlap, $1.95). Profusely illustrated, it deals with the seven Astronauts in training, diagrams their projected flight, shows the equipment that is being developed to place one of them in orbit.

• • •

*Ninety Seconds to Space: The Story of the X-15,* by Jules Bergman (Doubleday, $4.50), provides a close look at all aspects of the X-15 rocket test plane. This is worthwhile reading for professional and layman alike.

• • •

Former Lt. Col. Louis L. Snyder, professor of history at the City College of New York, has completed a monumental study of World War II entitled *The War: A Concise History, 1939-1945* (Messner, $7.95). It is the first volume to compress the war between two covers and combines readability with authenticity. The massive work divides into seven parts: The Prelude, Hitler's Days of Glory, Allies on the Defensive, Turn of the Tide, Smashing the Axis, Triumph of the United Nations, and the Epilogue.

• • •

Students and teachers from elementary through college level will be interested in the new *Selected Bibliography of Books About Jets, Rockets, and Space Exploration, 1958-1960* (OE-33002-2) compiled by Willis C. Brown, Specialist for Aerospace Education, Office of Education, US Department of Health, Education, and Welfare, Washington 25, D.C. It is a sequel to the first bibliography of the same name published by the Department in 1958 and including books appearing between 1953 and 1958 (OE-33002). Both bibliographies can be obtained free by writing to Mr. Willis C. Brown.

**NOTE: Any book reviewed in Airman's Bookshelf may be obtained, postpaid, from the AeroSpace Book Club, Mills Building, Washington 6, D. C. Full payment must accompany order. Information on the Book Club may be obtained from the same source. Club members are eligible for substantial savings on Club selections.**

## Technical Aerospace

*Focal Encyclopedia of Photography,* edited by Frederick Purves and others (Macmillan, $6.95). More than 2,000 entries cover every aspect of photography, photographic science, industrial photography, cinematography, portraiture equipment, history.

*Theory of Wing Sections,* by Ira H. Abbott and Albert E. Von Doenhoff (Dover, $2.95). Compilation of subsonic aerodynamic characteristics of modern NASA wing sections.

*A Treatise on Gyrostatics and Rotational Motion,* by Andrew Gray (Dover, $2.75). Reprint designed for students and engineers of theoretical dynamics.

*Aero Mechanics Questionnaire,* by Ralph Rice (Aero, hardback $6.50, paperback $5). Contains 2,225 mul-

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tiple-choice questions on all phases of aeromechanics subjects needed for passing FAA test for licensed airframe and power-plant mechanics test.

*AGARD Flight Test Manual* (Supplement 1960), edited by C. D. Perkins and E. J. Durbin (Pergamon, $15). Brings up to date the three volumes now in print.

*Combustion and Propulsion,* edited by A. M. Rothrock, A. L. Jaumotte, and A. H. Lefebre (Pergamon, $15). Fourth AGARD Colloquium on High-Mach Number Air-Breathing Engines.

*Thermal Reactor Theory,* by A. D. Galanin, translated from the Russian by J. B. Sykes (Pergamon, $15).

*Numerical Weather Prediction,* by Philip D. Thompson, USAF (Macmillan, $6.96). Treatise on the use of electronic computers as an aid to weather forecasting.

*Inertial Guidance,* by Charles S. Draper, Walter Wrigley, and John Hovorka (Pergamon, $6.50). Discussion of inertial-guidance system principles treating basic theory, system organization, functional features of components, operating characteristics, and inertial navigation.

*Space Research: The Proceedings of the First International Space Science Symposium,* edited by H. Kallman (Inter-science, $24.) Papers of scientists of all nations attending this COSPAR meeting in Nice, 1960.

*Aircraft Engines of the World,* by Paul E. Wilkerson (privately published, $15). New updated version of this valuable technical reference.

*Toward a Unified Cosmology,* by Reginald O. Kamp (Basic Books, $6.50). A radical new view of the origin and development of the universe and of the physical laws governing it stating all physical phenomena —the origin and nature of matter, energy, gravitation, the formation of galaxies, and so on, are within one simple, unified scheme based on a few universal principles. New matter is continually being created, while old matter is continually vanishing. Thus earth is steadily losing its mass. At one time it was substantially greater than it is today.

*Aeronautics and Astronautics,* edited by Nicholas J. Hoff and Walter G. Vincenti (Pergamon, $12). The proceedings of the Durand Centennial Conference at Stanford University cosponsored by the USAF Office of Scientific Research.

## Related Topics

*The March to Glory,* by Robert Leckie (World Publishing $3.95). Epic account of Marine withdrawal from Chosin Reservoir, Korean War.

*A Clash of Destinies,* by Jon and David Kimche (Praeger, $4.95). Story of the Arab-Jewish war and the founding of the State of Israel.

*Armour: A History of Mechanized Forces,* by Richard M. Ogorkiewicz (Praeger, $7.95). The first comprehensive account of armored forces, how they evolved, and how they fight.

*Sea Power: A Naval History,* edited by Elmer B. Potter (Prentice-Hall, $14.65). History from the fifth century to the present.

*Memoirs of General Lord Ismay,* by Hastings Lionel Ismay (Viking, $6.75). The record of the distinguished career of this British soldier-diplomat.

*The Taste of Courage: The War, 1939-1945,* edited by Desmond Flower and James Reeves (Harper, $8.50). A monumental anthology of World War II writings covering the drama, humor, and horror of military and civilians in combat.

*The Stars and Stripes' Story of World War II,* edited by Robert Meyer, Jr. (David McKay, $4.95). Anthology of the best from *Stars and Stripes* during World War II, featuring top correspondents and famous illustrations such as "Sad Sack" and Milt Caniff's works.

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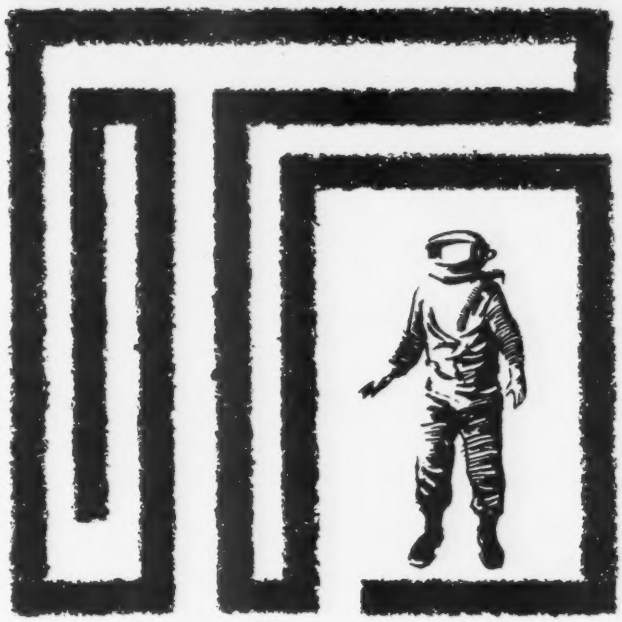

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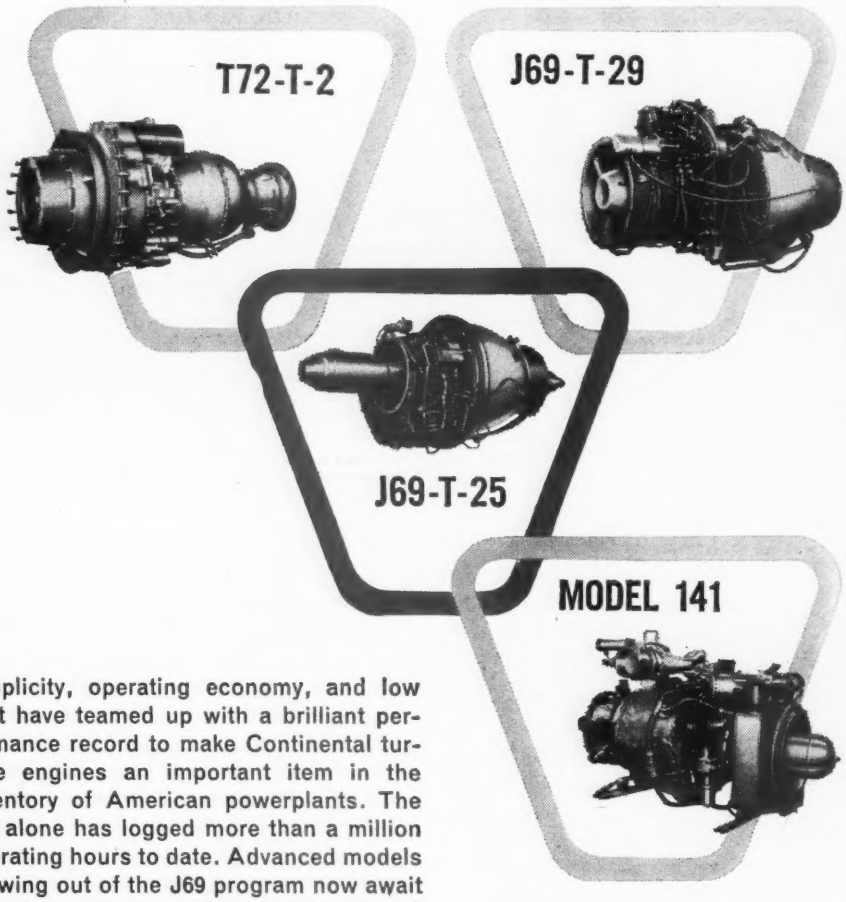


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## INDEX TO ADVERTISERS


Aerojet-General Corp. ..... 81
Aeronutronic, a Div. of Ford Motor Co. ..... 106 and 107
AiResearch Mfg. Co., Div. Garrett Corp. ..... 125
Allison Div., General Motors Corp. ..... 40 and 41
Alpha Corp. ..... 18
Amcel Propulsion, Inc., a Div. of Celanese Corp. of America 110 and 111
American Machine & Foundry Co., Government Products Gp. ..... 117
American Telephone & Telegraph Co., Bell Telephone System ..... 1
Antelline, Fred., Inc. ..... 122
Arma Div., American Bosch Arma Corp. ..... Cover 2
Autonetics, a Div. of North American Aviation, Inc. ..... 98
AVCO Corp. ..... 78
AVCO Corp., Nashville Div. ..... 54

Babcock Electronics Corp. ..... 113
Bell Aerospace Corp. ..... Cover 3

California Technical Industries, Div. Textron, Inc. ..... 116
Caterpillar Tractor Co., Defense Products Dept. ..... 114
Cessna Aircraft Co. ..... 119
Comptometer Corp. ..... 28
Continental Aviation & Engineering Corp. ..... 124
Convair, a Div. of General Dynamics Corp. ..... Cover 4

Delco Radio, Div. of General Motors Corp. ..... 14
Douglas Aircraft Co., Inc. ..... 4

Electronic Communications, Inc. ..... 12

Francis Aviation ..... 122
FXR, Inc. ..... 105

General Dynamics | Electronics, Military Products Div. ..... 32
General Electric Co., Flight Propulsion Div. ..... 56 and 57
General Precision, Inc. ..... 64 and 65
Government Products Group, American Machine & Foundry Co. ..... 117
Grand Central Rocket Co. ..... 93

Hughes Aircraft Co. ..... 82 and 83

I. T. E. Circuit Breaker Co., Special Products Div. ..... 67
IT&T Laboratories, Federal Div. .. 108

Laboratory for Electronics ..... 53
Librascope Div., General Precision, Inc. ..... 42
Lockheed Aircraft Corp. .....30 and 31
Los Angeles Div. of North American Aviation, Inc. ..... 7

Martin Co., The, Denver Div. ..... 97
McDonnell Aircraft Corp. ..... 72
Monsanto Chemical Co., Organic Chemicals Div. ..... 8, 9, 10, 35, 36, 37, and 38

Norair, a Div. of Northrop Corp. ..... 2 and 3
Nortronics, a Div. of Northrop Corp. ..... 70

Philco Corp., G and I Group ..... 89
Puritan Pressed Gas Corp. ..... 123

Raytheon Co. ..... 17
Ryan Aeronautical Co. ..... 94

Sikorsky Aircraft Div., United Aircraft Corp. ..... 26
Sperry Gyroscope Co., Surface Armament Div. ..... 13
System Development Corp. ..... 77

Texas Instruments Incorporated ..... 23, 25, 27, and 29
Thiokol Chemical Corp., Rocket Div. ..... 90
Thompson, H. I., Fiber Glass Co. .. 54

United Technology Corp. ..... 24

Vitro Laboratories, a Div. of Vitro Corp. of America ..... 86

Western Gear Corp. ..... 22
Western Union Telegraph Co. ..... 112
Westinghouse Electric Corp., Defense Products Gp. ..... 62

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**Thousands of civilian and military amateur radio operators belong to the all-volunteer, jointly sponsored Army-Air Force Military Affiliate Radio System popularly known as MARS. A standby emergency communication network, the system has distinguished itself in a range of functions . . .**

# GETTING THE MESSAGE THROUGH

**Lt. Col. Carroll V. Glines, USAF**

**Army Maj. Sidney S. Rexford, USAF Capt. William E. Bettis, chiefs of MARS radio network, in Pentagon.**

TEEN-AGER Jules Madey sat intently before his ham radio set in his home in Clark, N. J. It was after midnight, but time meant little to the bright young lad. He had just made contact with a station at McMurdo Sound in the Antarctic—the first amateur operator to do so.

"This is K2KGJ making a phone patch. Request all operators on this frequency stand by until completion of phone patch. Thanks for your cooperation and here we go!" he said into his mike.

Seconds later, an Air Force enlisted man at the South Pole in the exploratory Operation Deep Freeze was talking directly to his wife in New Jersey through Madey's combination short-wave radiotelephone hookup. A smile of satisfaction spread across Jules's face when he heard the "Hiya, Honey" that started the fifteen-minute conversation. A husband and wife, separated by thousands of miles, were able to "visit" through the amateur radio link.

Jules Madey, not a military man himself, is one of 15,000 amateur radio operators—military and civilian—who take part in the voluntary Military Affiliate Radio System, known popularly as "MARS." Serving without pay, he is a member of the quiet, efficient corps who have pledged their time, their equipment, and sometimes their funds to back up the Army and Air Force communications networks.

MARS is a joint program under the jurisdiction of the Chief of the Army's Signal Corps and the Air Force's Director of Telecommunications. Capt. William E. Bettis is director of the Air Force part of the program.

MARS is far more than a radio service for military men in remote duty assignments. Actually, it has a threefold purpose. First, it is designed to supplement regular communications between Air Force installations when other means of communication are overloaded, out of commission, or do not exist. Second, it creates interest in the broad field of military communications. Third, it offers training de-

MARS civilian volunteer in Fostoria, Ohio, talks to fellow operator.

Above, the console of a MARS station at Pentagon.

Below, a MARS mobile unit is seen in operation.

signed to stimulate interest in military or commercial career fields.

"We believe that a means of emergency communications must exist before the actual emergency occurs," says MSgt. Herman Philbeck, NCO assistant to Captain Bettis. "The thousands of messages to and from overseas relayed through MARS are factual evidence that our circuits are capable of immediate use. A lad like young Madey making a phone patch from the South Pole to a home in New Jersey is exercising this spare military communications net. We are glad that, in addition, MARS hookups often raise the morale of military men stationed far from home doing important jobs for Uncle Sam."

The system has proved itself hundreds of times in both local and national emergencies. A typical instance came in the summer of 1958 when a tornado struck the town of Menomonie, Wis. The local radio station was knocked out. All telephone lines in the area went down. On their own initiative the MARS airman-amateurs at Snelling AF Station, Minn., volunteered their services when they learned of the disaster through the state police. Breaking out a mobile unit that was gassed up and ready to go, they set up their station at the county courthouse. Other mobile ham operators cruised throughout the area locating places where help was badly needed. They radioed this information to the courthouse, where the MARS operators passed the dope on to the sheriff's office. Working around the clock, the airmen provided a desperately needed helping hand to one small town that had suffered a big tragedy.

Other crews of MARS volunteers have supplied similar services in emergencies ranging from Texas tornadoes to forest fires in California to floods in New England.

The MARS system contributed notably to rescue operations after disaster struck Chile last year. On May 21 and 22, 1960, the city of Puerto Montt and other South Chilean cities and coastal settlements were shattered by a series of violent upheavals which killed and injured hundreds. The MARS station at Albrook AFB in the Canal Zone acted as an important communications facility linking the stricken nation with the United States. It thus provided a valuable assist for the US emergency aid effort.

The same pattern of help via the radio waves was followed in March when an earthquake hit Agadir, Morocco. The MARS station at USAF's Benguerir Air Base, with its portable generator and radio, was on the spot within hours. In the first four days over 5,000 official messages and 500 phone patches were handled for the Air Force, Army, and Navy, the US Embassy, German and Italian Army Field Hospital units, and the Moroccan government.

Another recent example of MARS lifesaving messages is illustrated by this incident at Pepperrell AFB, Newfoundland. SSgt. Robert H. Wilder, a MARS member, was standing watch during his off-duty

*(Continued on following page)*

time when he was contacted by a Canadian amateur in Northwest River, Labrador, who requested a phone patch to Goose Bay. A doctor was badly needed.

Wilder found that telephone circuits to Goose Bay were inoperative but, in a manner typical of MARS ingenuity when it comes to getting a message through, he found another way. He radioed the Canadian Control Tower at Goose Bay, which in turn made a phone patch into town. Within minutes the sergeant had contacted a doctor. In a short time the help was on the way.

MARS personnel sometimes get into unusual message relays. A few weeks ago the mother and sister of an Air Force major were injured in a bus accident while motoring through Europe. The German hospital to which they were taken wanted to notify the major but all they could find out from the victims was his name. The Army MARS station in Heidelberg was alerted and called station K4AF, the MARS station located in the Pentagon concourse. Air Force personnel officials quickly checked their records. The major's German base was ascertained and a message quickly sent to his own base MARS station at Ramstein notifying him of the accident.

During an earthquake in Southern California, a civilian worker at Elmendorf AFB, Alaska, sought news about her parents who were living in the earthquake area. She asked the Elmendorf MARS station if it could find out whether or not the parents were safe. The request was received by a civilian MARS operator in Hollywood who tried to call the girl's home by telephone. However, telephone lines were down. The MARS operator in Hollywood contacted a fellow ham operator who was cruising through the area in his car with a portable unit. The young lady in Alaska described the streets for him. The ham operator drove through the area and found that her parents' section of town was undamaged.

"These incidents contribute to the main MARS mission," Captain Bettis, USAF's MARS director, observes. "MARS must provide us with a source of trained personnel and a system in being around the clock. The MARS organization is truly a corps of dedicated, sincere men and women who are ready to serve at a moment's notice no matter what the emergency. Their repeated success in getting messages through in spite of the most difficult of circumstances is proof that MARS can accomplish its mission."

**Here Cleveland member of MARS records message in Braille as it comes in at station he and his father built. Youth has been blind for past several years.**

Membership in MARS runs like a cross section of American life. Among members are several Air Force generals, including General LeMay; priests, a Hollywood actress, lawyers, salesmen, watchmakers, dentists, engineers, advertising executives, oilmen, students, forest rangers, mechanics, and a prison correction officer, and just about any other kind of people imaginable.

On the Air Force MARS program books right now are over 9,100 members. The Army lists some 5,200 on its rolls. Two-thirds of them are civilian amateurs. The rest are military personnel who contribute their off-duty time to man the MARS networks.

To join, an individual must be at least sixteen years old and hold a valid amateur radio license issued by the Federal Communications Commission. He or she must possess a station in operation capable of operating on at least two MARS frequencies with a frequency accuracy of one-hundredth of one percent. Applications are received by MARS stations or by the Chief, MARS Air Force, Room 1-217, Tempo "E," 4th and Adams Drive, S. W., Washington 25, D. C.

Civilian amateurs who join MARS are not members of the uniformed services. They serve voluntarily without pay or hope of reward. However, by agreeing to comply with MARS procedures they can receive on-the-air training in military communication procedures and instruction in the use and modification of military communication equipment. They may take Army and Air Force electronic extension courses and receive excess and obsolete communications equipment and supplies for experimentation, modification, and cannibalization. If they are Reservists, they can receive credit for MARS participation toward promotion and retirement. If they enter the armed forces, their MARS certificates can help them get a military communications assignment.

Getting the message through has become a tradition with MARS personnel. Come hell or high water (literally), the MARS fraternity of amateur communicators whose messages crisscross the world's air waves can be depended upon to act and react with quiet efficiency whenever needed. MARS has earned a firm place on the organization charts of the Army and Air Force because it has done and can do so much at almost no expense to the taxpayer.—END

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*The author, Lt. Col. Carroll V. Glines, is Chief, Planning Team, Monitoring System Group, Directorate of Operational Requirements, Hq. USAF. He is a frequent contributor to the pages of* AIR FORCE/SPACE DIGEST.

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